THE FERNS,

ALDERLEY EDGE, NEAR WILMSLOW, CHESHIRE

RESEARCHES

INTO THE

EFFECTS OF COLD WATER

UPON THE HEALTHY BODY,

TO ILLUSTRATE

ITS ACTION IN DISEASE;

IN A SERIES OF EXPERIMENTS PERFORMED BY THE AUTHOR UPON HIMSELF AND OTHERS.

BY

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Ἀτελὴς ἄλογος πρᾶξις, καὶ λόγος ἄπρακτος.

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ADDRESS TO THE READER.

Although this treatise is dedicated to the medico-chirurgical colleges of London, and although its essential nature is intended to be such as to render it suitable for the perusal and criticism of the medical profession, still the author hopes it will not on that account be shunned by the non-professional person. For the latter must know, that neither in diction, nor in sentiment will there appear any medical technicality, so as to unfit it for his full and easy comprehension. The reader, both lay and medical, is particularly requested, before he commence the volume, to correct in ink the following errata:—Page 3, line 6 and 7 for + read ×. Page 6, line 26, for 39.13 read 39.14.

DEDICATORY EPISTLE.

TO THE LONDON COLLEGES OF PHYSICIANS, SURGEONS, AND APOTHECARIES,

GENTLEMEN,

Permit me with profound respect to inscribe to you this unpretending treatise. The title-page will inform you that it is written with the *primary* object of inquiring into the physiological effects of cold water upon the healthy body, and with the *ultimate* object of illustrating its therapeutic agency in disease. Long before commencing the manuscript, I was surprised that there had been no philosophical experiments instituted upon this subject. Whenever a new drug is proposed to the profession for their employment in disease, before it can be admitted into the pharmacopœia, it undergoes a vigorous scientific examination. It is first scrutinized physically. Its odor, its taste, its mechanical properties are thoroughly investigated. It is then submitted to chemical analysis. Its elementary constituents are disclosed both as to their nature and as to their quantity. If so far the search has proved satisfactory, the next stage in its examination is to trace its physiological action upon different animals, that are nearly allied in their anatomical structure to the human race. And after it has thereby been discovered to be possessed of no poisonously acrid properties in certain doses, it is tested ex-

perimentally upon man in a state of health. Having at last run the gauntlet of these multifold, but most requisite and most excellent modes of inquiry, it is pronounced fit to be employed as a remedial agent, and is administered accordingly. And this, gentlemen, is the way in which, when cold water was first introduced into England as a therapeutic agent, it should have been immediately submitted to the test of experiment. All such medical gentlemen as were favourably disposed to the new system, should have contributed their quota of scientific research, and in brief plain language, free from all invective and exaggeration, laid the results of their labors before their professional brethren. Instead of which, as far as I am aware, not only has no such work been written, but not a single one of the numerous books, that have been published on the subject, has been so much as dedicated to the profession. Nay, few, very few have been conceived in such a spirit, or clothed in such language, as to bear reading on the part of medical gentlemen, whose consciences are satisfied with the present mode of practice. And I am compelled to admit with extreme regret that there have not been wanting hydropathic treatises, which, instead of proving on scientific grounds the excellence of their remedial system, have in a cowardly manner sought to exalt it by simply abusing the established system of medicine. To such an extent was this, and it is still, carried, that many persons now wince at the very mention of a "drug." But this is most absurd. For these very men are continually swallowing drugs without their knowledge. For, if they be constipated, do they not eat green vegetables, or brown bread pudding? And if they be relaxed, do they

not give the preference to rice? now take the boiled cabbage, the brown bread pudding, or the rice; evaporate it to dryness; submit it to pestle and mortar; bottle it, and put it on an apothecary's shelf; and I maintain you have as perfect a drug as rhubarb, jalap, or aloes. What is a drug? Where is the mystery? What is rhubarb, but so much powdered and bottled brown bread? I have no objection to rhubarb, and jalap *per se*, but brown bread, and cabbage are so infinitely more convenient, so infinitely more palatable, and so infinitely more within my control, that I prefer them to the former.

It is true that most works on hydropathy have detailed cases. But why should the medical profession put faith in them, any more than in the cases reported in the advertisements as cured by Holloway's pills? For it must be remembered the subject had never been legitimately brought beneath their notice. They had no idea what the varied application of cold water *could* do. They were perfectly justified therefore in treating the whole system as empirical. But if those, who first adopted hydropathy, had preceded their cases by experimental proof of its *capabilities*, their cures would not have been ascribed to change of air, change of diet, or mere chance, but in part at least to the physiological power of cold water as a remedial agent. Believing therefore that in this matter there was laid bare an immense gap in hydropathic literature and hydropathic credit, that should be obliterated as soon as possible, I thought I would immediately endeavour to fill it up with what skill I could command. Part of this duty, gentlemen, I am now accomplishing in soliciting the attention of the medico-chirurgical colleges of London to the following experimental researches.

I have said that, before a new drug is admitted into the category of remedial agents, its properties are examined *physically*, *chemically*, and *physiologically*, in reference both to animals, and to the human species. Now the physical characters of water are known to every one. And any elementary work on chemistry will describe the results of its chemical analysis. It only remained therefore to investigate it physiologically. And even for this enquiry there were two large fields open, viz. the animal species, and the human. I should have liked extremely to have prosecuted my search into the effects of cold water upon both these classes. But hitherto it has fallen to my power only to accomplish my desires so far as concerns the human system. The results of my exertions in this matter I now lay at your feet with every feeling of respect, and with full confidence that you will pronounce judgment upon the work, favourably or unfavourably, according to its real merit.

I am, gentlemen,

Your most obedient servant,

HOWARD F. JOHNSON.

The Ferns,
Alderley, near Wilmslow,
Cheshire.

EXTRACTS FROM A LETTER BY THE AUTHOR IN REPLY TO AN EMINENT MEDICAL PRACTITIONER AND FRIEND, WHO BEING ALTOGETHER UNACQUAINTED WITH THE HYDROPATHIC SYSTEM DESIRED A LITTLE INSIGHT INTO ITS NATURE.

My dear Sir,

You are totally in the dark. Hydropathy in 1850 is not the *water-within*, and *water-without*, that it used to be. Nor does it consist in the indiscriminate employment of sheets, douches, and sitzes. It does *not* enjoin an inundation of the stomach, converting the natural drink of man into a poison. It no more wishes that organ to be a water-butt, than a wine-butt. It does *not* pretend to be a panacea, nor an elixir of life. Such pretensions are not those of legitimate and orthodox hydropathy, but of the empirical and incompetent practisers of that system. Let me request you therefore immediately to disabuse your mind of these most erroneous ideas. * *

Orthodox and *rational* hydropathy is not a *dissent,* or secession from the medical profession. Nor is it, as you seem to think, a rival to your practice. This you will soon perceive, when I explain to you what it is. It consists of two kinds of treatment—negative and positive. The first kind implies an abstinence from all those causes that commonly engender disease; and of course especially from those, that may have produced the disorder in any particular instance. Hydropathic patients are necessitated to abstain from, firstly, the cares and confinement of business; secondly, too close study; thirdly, alcoholic fluids;

fourthly, protracted medication, &c. The positive ordinances require, firstly, the normal amount of exercise, neither too much nor too little; secondly, a strict enforcement of early hours; thirdly, a nutritious, but plain dietary; fourthly, a salubrious climate; fifthly, and lastly, *the most important of all*, the *sine qua non*, the ESSENTIAL *of the system*, the scientific administration of certain water appliances. This latter is indispensable. The other matters, although always insisted upon, may nevertheless be looked upon as so many important auxiliaries. * * *

It is useless for me to point out to you, who are a medical man, the great advantage of these salutary regulations. You are acquainted with them as thoroughly as I am. You daily recommend and urge and insist upon their observance in your professional character. But the difference between you and me is this, I *enforce* it, and you do not. Not *living with* your patients, you cannot do so. It is impossible. Who has not heard of the anecdote of the famous Dr. Jephson? He ordered a patient to take a single glass of wine daily, which the latter promised to obey, and did obey. But a little time afterwards, as he did not manifest so much improvement as was expected, the doctor inquired minutely into his dietary, and among other things wished to see his wine glass. It was brought, and found to be a *tumbler*. A most pitiful subterfuge! perverting the sense, but not infringing the words of his compact. But had this patient been a resident in a hydropathic establishment, he *could* not have been guilty of this paltry trick, inflicting injury on himself and discredit on his doctor. *There* the physician knows exactly what each patient "eats, drinks, and avoids." There no wine or other

alcoholic fluid is allowed to enter the house without the physician's express sanction.

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You have read "Sandford and Merton?" In that book is mentioned a celebrated physician, notorious for his wonderful power of curing the ailments of the rich. What was his practice? He put his fat, unwieldy, over-fed patient into a room, floored with sheet iron, and without a carpet, chair, or furniture of any kind. Here he is left supporting his ponderous weight against the wall. Now this shrewd doctor had a cunningly devised apparatus beneath the floor of the room, by means of which he could elevate the temperature of the iron boards to any height he chose. No sooner therefore is the patient left to himself, and the door locked upon him, than the floor begins to grow warm. He is surprised, but dreams not of the treachery that is soon to be revealed. Presently however his feet become warm, agreeably so, then hot, disagreeably so, and the truth flashes upon his horror-stricken nerves. To cool one foot, he raises it, and leans his whole substantial person upon the other. Then he shifts about, reversing the position. Anon he lifts both legs at once, and hangs by the arm-pits upon his crutches. Meanwhile his mental perturbation equals his bodily discomfort. He becomes angry, enraged, furious. He shouts, swears, and sweats. But the cruel iron gets hotter and hotter. It would now do a dancing-master good to witness his agility. He shames both harlequin and columbine. Taglioni, Grisi, or Grahn never performed such leaps as he does. And just as he is in a phrenzy of excitement, and the perspiration is streaming like a river down his sides, the doctor,

who has been coolly regarding him the whole time through an eye-hole in the wall, unlocks the door, and lets him out. Well, after this discipline, he is kept waiting for his dinner, till he is almost frantic with hunger, rage and despair. And when at last it does come, instead of the luxurious food to which he has been accustomed, instead of the ragouts, and sauces, and wines, a few dried fruits, dry bread, cold meat, and a jug of cold water are set upon the table.

Why, what is all this but hydropathy? This cunning physician was an hydropathist every inch; in every thing but the name. Had he lived in these days, he would have been so in name also. Will you tell me he had no bath? that is, none of the characteristic and essential part of the hydropathic system? True, and for that very reason, although he had all the hydropathic adjuncts, he neither did nor could perform the multifold and diversified cures that we both can and do effect.† * * * *

† What follows concerning the various modes of employing the water itself is omitted here, as the whole of the future pages have reference to this point.

HYDROPATHIC RESEARCHES.

INTRODUCTORY CHAPTER.

ON THE HARMONIOUS RELATION OF THE HEART AND LUNGS, AND OTHER MATTERS.

These researches were prosecuted in the first place to ascertain any physiological hydropathic facts that might happen to be proved by them, such facts, although demonstrated upon the healthy body, being capable of affording much valuable aid in the treatment of disease. On this subject something has been said in the dedicatory epistle, and it will be continually illustrated through every one of the following pages. But besides this general purpose, there was one particular object in view, which was to gain correct and exact information concerning the effect of hydropathic processes manifested upon the functions of respiration and circulation. The result of the experiments prove in the latter matter, beyond a doubt, that the action of hydropathy is to augment the rate of speed of the respiration, in proportion to the pulse, beyond the latter. This the reader will realize for himself by and by. In the meanwhile the author thought it would be advantageous to premise thus much, and to explain in an introductory chapter the beneficial influences on the system, arising from this effect upon the respiration, in order that

the reader, when he sees this statement verified by actual experimental proof, may be prepared to appreciate the value of such experiments.

This work, being intended for both medical and lay readers, the former class will find much in this chapter that they knew before, but nevertheless the author hopes they will derive some interest from its perusal, since all the physiological and pathological matters mentioned have to them a new, namely, a hydropathic tendency. Apologizing therefore, to the professional reader, for some explanations, of which he, of course, stands in no need, but which it is necessary for the clear elucidation of the subject, to lay before the non-professional one, the author proceeds to enter upon his tale.

The lungs are the organs wherein is conducted the aëration or purification of the blood. And the heart is the organ which, with a pump-like action, conveys the blood thereto. This fluid enters the air-cells, of which the pulmonary tissue is constructed, dark, venous, impure, carbonized, and issues from them florid, arterial, pure and decarbonized. These changes are effected by the decomposition of atmospheric air (which takes place within the pulmonary air-cells), the absorption and appropriation of its oxygen, and the extrication of carbonic acid.

It has been proved (see the chapter on the shallow bath) by experiments, conducted by the author, upon his own person, that the average pulse during the twenty-four hours, in a healthy man, numbers about 72.73 beats per minute, and that the average number of respirations that occur under the same circumstances, during the same period, is about 19.31. So that they stand in proportion to each other as 3.76 of the former to 1 of the latter. Now, at each inspiration, about one pint of air is imbibed. This therefore would be devoted to the purification of as much blood as would be impelled into the lungs by 3.76 contractions of the heart. At each contraction of the

heart, or, which is the same thing, at each beat of the pulse, about two ounces of blood are pumped by that organ into the purifying apparatus, the lungs. So that the case now stands thus: at each inspiration, cœteris paribus, in healthy individuals one pint of pure air is absorbed into the lungs to aërate, or purify 2oz.+3.76 of vitiated blood, and 2+3.76=7.52. Therefore one pint of air is just sufficient for 7.52 ounces of blood. This constitutes the correct equilibrium or harmonious balance between the heart and lungs.

But if at any time this equilibrium be disturbed, so that, for example, there should be more than 7.52 ounces of blood sent for aëration to the lungs per minute, or less than one pint of air inhaled, or if that pint contain less than normal (viz., 21 per cent.) of its purifying ingredient, oxygen, then, these conditions not being fulfilled, the blood is insufficiently decarbonized, and disease is the result. Instead of losing its dark colour and venous character, becoming of a bright red tint, and assuming the arterial peculiarities while permeating the tissue of the lungs, it passes out of those organs, of course more or less, in the same state as it entered them. And, inasmuch as dark, venous blood owes its color and character to the fact of its being loaded with the detritus of the old, worn-out tissues, and it is only arterial, scarlet blood, which has got rid of those impure elements, and owes its brightness and excellence to the presence of oxygen, that is capable of nourishing the structures of the body, the consequence of such insufficient decarbonization of the blood must be the insufficient nourishment of such tissues. And this being the case, diseases of as many kinds as there are different tissues in the body necessarily ensue.

This is the way in which crowded rooms, balls, concerts, &c., often exercise a very injurious effect. The atmosphere of the apartment becomes surcharged with the breath,—that is, the carbonic acid exhalation,—a por-

tion of the refuse of worn-out tissues of a large concourse of people, in consequence of insufficient ventilation,—the exchange of pure oxygenated air from without for the impure carbonized or deoxidized air within. As the lungs continue their natural movements the inspiration of this vitiated air, of course, takes place. And as the heart goes on pulsating—pumping blood into the lungs for aëration—as quickly as, or even more quickly than under ordinary circumstances, more of this vital fluid is presented on the pulmonary surface for purification than the amount of air inhaled, in its present polluted condition, is capable of decarbonizing. What follows? The blood passes on—for it must pass on purified or non-purified—*undecarbonized.* It enters the lungs *venous,* it remains *venous,* and it departs *venous.* It now flows to the left side of the heart, and enters the arteries in its unchanged venous state, whither none but arterial blood should penetrate. By means of these vessels it is distributed to all the tissues of the body to nourish them, when it is no longer capable of nourishment. Failing to nourish them, it is not simply inert, but becomes actually a poison. Among other parts this poison pervades, the brain stands prominent. Nor is it difficult to understand how this delicate substance, accustomed to the approach only of bright, arterial blood, should speedily betray the ingress of this polluted fluid by manifesting the symptoms of poisoning. Hence the fainting, swimming of the head, confusion, giddiness, and the endless train of symptoms of cerebral disturbance, such constant attendants on the crowded room and public spectacle.

By reference to the chapter on the shallow bath, the reader will discover a table of experiments, which the author performed upon his own person to establish the normal relation that exists between the functions of respiration and circulation. For convenience sake, namely, to assist here in the elucidation of the matters he is now

going to explain, he entreats permission to quote those experiments entire, at the same time directing the reader to the chapter on the shallow bath, for information on the mode of their performance, the origin of their institution, &c., &c.

Time of day.	Pulse.	Respiration.	
A.M.			
7.	64	14.	before rising in the morning.
7.30	61	14.5	
7.45	62.4	17.8	before walking.
8.	80·3	38.4	after walking briskly.
8.30	86.	20.	after breakfasting at 8.
8.45	84.	17.	
9.30	93.	26.	while out walking at a moderate pace.
10.	88.	24.5	
10.45	68.	14.5	sitting quietly in his study.
11.	68.	17.	
P.M.			
1.	66.	15.5	dining at half-past one.
1.20	60.	15.5	
2.15	72.	18.	
2.45	70.	15.5	
5.	88.	30.	while out walking.
6.	63.	17.	sitting quietly in his study. Tea was taken at 7 p.m.
8.	71.	16.5	
11.	64.	16.	

From simple calculations made from these eighteen experiments, it is ascertained that the average number of pulsations of the heart per minute, is about 72.73, and that the average number of times the ribs rise and fall, constituting an inspiration and expiration, or in one word, a respiration, is 19.31 per minute. And as 72.73 arterial throbs are to 19.31 respiratory movements, so are 3.76 to one. This then, on very good grounds,

[consult the chapter on the shallow bath] is considered the index or standard of harmonious relation between the action of the heart and lungs, these being the organs of circulation and respiration. But these conclusions are drawn from an impartial analysis of experiments, performed during all periods of the day, and under the most diversified circumstances. Some of them, for example, were accomplished immediately after brisk walking exercise, and others after sitting perfectly still. It will be found that in all those that were conducted during or after exercise, the respiration is very frequent in proportion to the rapidity of the pulse. On the other hand, those executed during perfect repose of the body, evince just as regular a comparative acceleration of the pulse above that of the respiratory movements. As specimens of the former may be enumerated the fourth, seventh, eighth and fifteenth experiments. If an average estimate of the comparative speed of the pulse and breathing were deduced from these four alone, it would be found to be very different from the results just detailed. The average respiration would be 29.72 instead of 19.31, discovering a difference of no less than 10.41. The average pulse would be 87.45 instead of 72.73, discovering a difference of 14.72, actually (that is in figures), greater than that in the case of respiration, but virtually much less. For as 1 : 3.76 :: 10.41 : 39.13. So that, 3.76 being the figure representing the normal average number of beats of the pulse corresponding to one respiration, 39.14 would, in the same proportion, indicate the number of pulsations balancing with 10.41 respiratory movements. But we have seen that in these four experiments, that were performed while the body was under the influence of walking exercise, although the pulse and respiration both manifested considerable increase in rapidity, that of the latter was the most marked. Whereas the latter experienced an additional 10.41 movements per minute, the former only gained 14.72 pulsations.

On the other hand, if an estimate were formed of the average rapidity of the pulse and respiration, from a consideration of those experiments only that were accomplished while the body was in a perfect state of rest, as, for instance, from the first, second, eleventh, and twelfth, a vastly different effect would be the result. The average respiration would number 14.87 per minute, instead of 19.31, manifesting a difference of diminution of 4.44. The beats of the pulse would be 62.75, instead of 72.73. Here also is a decrease, namely, of 10 in the whole number within two-hundredths. So that although, in this case, there is a depression of both pulse and respiration, there is comparatively a considerably greater depression of the latter than of the former, since one respiration is equal in value to 3.76 beats of the pulse, and $4.44 + 3.76 = 16.69$. The respiratory movements decreasing therefore to the extent 4.44, the pulse to correspond accurately with this diminution would have fallen 16.69. The respiration consequently exhibits the largest fall.

If the reader has carefully followed these statements and calculations, he will now distinctly understand,—firstly, that the numerical equilibrium between the pulsations of the heart, and the movements of respiration, is, in the normal condition, as 3.76 of the former to one of the latter ;—that this correct and healthy equipoise, however, is only maintained when there is a due amount of exercise taken, that is, when the body undergoes the salubrious change of rest and motion,—secondly, that exercise accelerates both pulse and respiration, but the latter more extensively than the former,—thirdly, that perfect repose of the body causes a diminution in the speed of both these functions, but of respiration in the most marked manner,—fourthly, and lastly, that the greater the number of respirations in a given time, or in proportion to the beats of the pulse, the more healthily are discharged the living actions, and of course, vice versâ, the more dilatorily the office of respira-

tion is performed, the more speedily do these functions yield to the encroachments of disease.

Now it will be readily understood how deleterious an influence the sedentary pursuits, so indispensable in the present state of society, can exercise in impeding the action of the lungs. First, the constrained stooping position necessary in either reading or writing, and mechanically cramping the lungs; next, the absence of all active motion, causing debility of the muscles of respiration among other parts; then the inhalation of a warm, and, however cautious the person may be to provide against it, not perfectly pure atmosphere, the former, as well as the latter condition, being highly injurious to the very susceptible pulmonary membrane; all these circumstances, and many others, upon which it would be irrelevant here to enlarge, conspire to retard the respiratory movements, and to entail upon the individual the necessary destructive consequences. These soon loudly declare themselves in many forms,—in the shape of cerebral symptoms, as, confusion of ideas, giddiness, impaired memory, headache, and a legion of others, indicative of the flow of impure blood, that is, *venous, unoxygenated, undecarbonized,* through the delicate structure of the brain, producing as venomous an effect as the inhalation of so much carbonic acid gas; or in the shape of dyspeptic symptoms, as flatulence, heartburn, pain at the pit of the stomach, constipation, &c. &c., generated by the same undecarbonized blood flowing through the textures of the stomach and bowels, or in the shape of uterine symptoms, which appear to become more frequent almost day by day, and hour by hour, or, lastly, in the very fatal shape of consumption. In the year 1838, according to the Registrar's Annual Report of Births, Deaths, and Marriages, out of the total deaths in England and Wales, no less than 27.5 per cent. were attributed to disease of the lungs, and out of these, consumption slew a no smaller number than 59,025. To what can this frightful mortality be more

justly ascribed, in part at least, than to the unwholesome sedentary habits of the present day? In a close, ill-ventilated, heated, atmosphere, debarred from the natural stimulus of cool, pure air, and healthful exercise, mechanically cramped in their movements by a forced and unnatural position, is it to be wondered at that the lungs become a fertile soil for the scrofulous seeds of consumption to take root, and flourish?

The same unwholesome, confined pursuits, by the constraint they put on the respiration, give rise to the development of an inordinate amount of fat. This substance, so unsightly to the physiologist, because so hurtful to the system, when existing in superfluous abundance, consists essentially of two elementary ingredients, carbon and hydrogen, and it will easily be made manifest to the reader, how retardation of the respiratory process causes its superabundant deposition in the tissues. The air we take into the lungs in respiration is composed of oxygen and nitrogen. The air that is evolved from the lungs consists of nitrogen, carbonic acid gas, and aqueous vapor. The nitrogen comes in and goes out precisely in the same condition, unchanged. It is united with the oxygen merely for the purpose of dilution, for *pure unmixed* oxygen is too irritating for the lining membrane of the pulmonary air-cells, and on that account is itself as poisonous to breathe as any atmosphere altogether deprived of this vital gas. Carbonic acid is a chemical combination, in definite proportions, of carbon and oxygen. Aqueous vapor, or vaporified water is also a definite chemical compound of oxygen, but hydrogen, not carbon, is its other ingredient. Oxygen, therefore, enters the lungs simple, uncombined (for it is not *chemically united*, but merely mechanically mixed with the nitrogen), and it returns, combined chemically with two other substances, viz., carbon to form carbonic acid, and hydrogen to form water or aqueous vapor.

Now the worn out effœte tissues of the body, having ful-

filled their object in the animal economy, escape from the system in a highly attenuated form, through various outlets, as the skin, kidneys, lungs, &c. But they do not rush pêle-mêle through the first outlet they come to, but each substance, according to the nature of its composition, has a particular excreting organ adapted for its transference to without. For example, those matters that are rich in nitrogen have to pass through the kidneys, while those, in which carbon and hydrogen prevail, make their exit through the lungs. But it has been stated that these elements combined in certain proportions, are the constituents of fat. Yes, and it is precisely in this way that obesity takes its origin. By diminished respiration, consequent upon sedentary habits, a large quantity of carbon and hydrogen, which should be eliminated from the body through the lungs, is retained in the system. But, inasmuch as having performed its office, and being incapable of further duty, it would not only be useless, but even poisonous, were it to continue in the circulation; it is happily got rid of in a peculiar manner, namely, it is deposited in different places, in the shape of fat. This then is the physiological origin of that very useless incumbrance, and beyond a question, most unnatural eye-sore, corpulence.

But where is the lodgment of fat effected? We see it on the exterior of the body, beneath the skin, more especially about the region of the abdomen. We see it in the face, the arms, the legs, &c. &c.; but we do not see it in the heart, the lungs, and other viscera. Let it be remembered, however, that the deposition of fat goes on in the region of those most important organs with the same pace that it invests the periphery of the body;—the public are not generally aware of this vital fact, it is nevertheless true. Just as the cheeks begin to puff out, and the healthy abdomen to become converted into the unhealthy paunch, at the same time the thoracic viscera, the heart, the large vessels, the cardiac nervous ganglia, the roots of the lungs,

&c., begin to receive their load of adipose tissue. As the external corpulence increases, so does the internal corpulence increase. As the corpulence of the legs and abdomen impede and clog the movements of the limbs, so does the corpulence within the chest impede and clog the movements of the heart, large vessels, and lungs; in one word, in proportion to the increased difficulty of locomotion, is there increased difficulty of circulation and respiration, so that there is developed a complete circle of evils. Firstly, the respiratory process is accomplished in a dilatory, inefficient manner, which supervenes necessarily upon the confinement of inactive pursuits. Secondly, the consequence of this evil is the non-aëration, or non-oxygenation of a considerable proportion of venous blood conveyed to the lungs to be purified, and the inevitable retention in the system of a large quantity of carbonaceous and hydrogenous matters, that should have escaped in the form of carbonic acid and water. Thirdly, these two elementary substances, to avoid deleterious effects resulting from their now poisonous character, are thrown aside as useless lumber, into various nooks and corners, in the shape of fat. Fourthly, one of these receptacles is situated in the cavity of the chest, about the base of the heart, roots of the lungs, and trunks of large blood-vessels. Fifthly, it follows that the growth of fat in this most vital neighbourhood, is attended by great detriment to the general health, affording, as it does, a weighty obstacle to the movements of the viscera of circulation and respiration. Thus, then, it will be seen that the beginning and the end of this chain of miseries is the same, namely, impeded breathing, the same, that is to say in kind, but not in degree, for the last is, of course, much greater than the first. It is on this account, viz. the accumulation of fat about the thoracic organs, that we see stout persons labor for breath on ascending a hill, or walking up stairs; and that we see them stop and pant on slight muscular exertion. Is it to be wondered at that so many of such over-fat subjects die suddenly?

Both to counteract the tendency to this disease (for it is a disease) and to cure it when established, it will be proved by the following experimental researches that hydropathic applications, independent of all hygienic rules, as dieting, exercise, &c., are, by a specific action upon the lungs an efficient remedy.

When a piece of wood is ignited it evolves light and heat, which are the result of one simple chemical combination, namely the union of atmospheric oxygen with the carbon and hydrogen of the wood. It is a mere process of oxidation. During the inflammation the wood diminishes in size, and aqueous vapor and carbonic acid gas are liberated. From precisely the same condition of things is animal heat generated and maintained. The tissues of the whole human frame are constantly undergoing a chemical combination with oxygen prior to, and indeed to enable, their removal from the body. The carbon and hydrogen present in those tissues enter into union with oxygen, the resulting compounds being water and carbonic acid. And from this chemical decomposition and combination animal heat is generated. Hence it follows that the amount of animal heat generated must depend upon the amount of chemical action occurring in the tissues, that is of course, the more chemical action the more warmth, and the less chemical action the less warmth. But the energy of this chemical change in the tissues is regulated entirely by the quantity of oxygen conveyed to them for that purpose. The oxygen is conducted thither by the blood having entered that fluid while passing through the lungs during the process of respiration. And of course the quantity of oxygen imbibed by the blood in the lungs depends entirely upon the frequency of respiration. Ergo, animal heat depending upon chemical action in the tissues, this chemical action depending upon the oxygen conveyed to those tissues for that purpose in the blood—this oxygen depending for its entry into the system upon the process of respiration—it

is an inevitable sequitur that the more frequent the breathing the more animal heat is generated, or, in other words, the warmer the individual becomes.

Inasmuch as sedentary engagements diminish the frequency of respiration as before explained, so do they give rise to the unpleasant train of symptoms that characterize the invalid whose natural sources of heat are burning low. Who that is engaged in such avocations as preclude active exercise, but is painfully acquainted with chilliness, shivering, cold feet and hands, tendency to chilblains, liability to take cold from every draught, blue nose, and tingling ears on going into the air, and a myriad of similar disagreeable symptoms? But besides these comparatively trifling matters, these unfortunate individuals frequently suffer in a much more important manner, for they are apt to fall into a cachectic, miserable condition, that invites the entrance of disease, and quickly yields the body a prey to its attack: their whole system appears to become disordered generally, without affording the power of fixing upon any particular organ as the seat of the mischief, thus, the nervous system is shattered, the muscular system is flabby and debilitated; the mucous membranes are all wrong; an immense amount of irritation, obstruction, or engorgement, declares itself in most of the internal viscera; dyspeptic symptoms supervene, bowels constipated, tongue parched and foul, appetite capricious or gone, flatulence, heartburn, colicky pains; in one word, his constitution is ruined, and his life a bugbear. But in the following pages it will be proved that all these horrors can be both prevented, and, when developed, cured by hydropathic applications, through their specific effect upon the respiration.

In this country pulmonary consumption is frightfully prevalent: that fact is universally known, but the cause of the great mortality from this disease is certainly not generally understood. Dampness of the climate, and predispo-

sition from hereditary taint, receive all the blame, assuredly without justice. In the year 1838, as has been before mentioned, it was shewn by the Registrar General's Report, that of all the deaths that occurred, twenty-seven and a half per cent. were due to disease of the respiratory organs; the actual number of these latter was 90,823, of which 59,025 were laid at the door of consumption alone. This Report further states that in the same year for every 3.8 males that died of consumption, this disease carried off 4.1 females. Commenting upon these facts, Mr. Farr speaks in the following forcible words :—

"This higher mortality of English women by consumption may be ascribed partly to the in-door life they lead, and partly *to the compression preventing the expansion of the chest, by costume. In both ways they are deprived of free draughts of vital air, and the altered blood deposits tuberculous matter, with a fatal and unnatural facility. Thirty-one thousand and ninety English women died in one year of the incurable malady!* Will not this impressive fact induce persons of rank and influence to set their country women right in the article of dress, and lead them to abandon a practice which disfigures the body, strangles the chest, produces nervous and other disorders, and has an unquestionable tendency to implant an incurable hectic malady in the frame?"

Hence then it appears that the practice of wearing stays, by the compression they exercise on the lungs, thereby *impeding the respiration*, is one fertile source of consumption. Another cause for the prevalence of this fatal disease may be found, beyond a doubt, in the constrained position of those, whose pursuits compel them to sit much in one posture. The hot, dense, and vitiated air of saloons, and crowded assemblies, is also prolific in its production. In short anything that obstructs the process of respiration, is capable of giving rise to the deposit of tuberculous matter in the lungs. And, therefore, since the hydropathic appliances have the effect, as proved by the ensuing experiments, of augmenting the rapidity and depth of the breathing process, of course they have a tendency to prevent scrofulous and other pulmonary complaints.

It will be appropriate now to speak of the beneficial influence exerted by increasing the strength and frequency of the respiratory function in the removal of chronic disease. It will be in the first place readily granted, that all disease must be either functional or organic. By organic disease is meant such disease as is revealed to the senses, tangible, visible, as an ulcer in the stomach, valvular disease of the heart, congestion of the brain, &c. By functional disease is meant such disease as is not amenable to the senses of sight and touch, but whose presence we recognize nevertheless by the most unmistakable symptoms, as, for example, neuralgic or tic pains, nervous headache, irritability of the heart, &c. It is also commonly supposed that in the latter case there is really no physical disease at all—that the organ or part, whatever it may be, that is affected, is disturbed in the discharge of its function, that it *goes wrongly*, so to speak, or acts wrongly, without there being any real, bonâ-fide, substantial disease to account for it. For example, a lady suffers very much from palpitation of the heart, but there being no stethoscopic signs of disease in that organ, and there being none of those collateral symptoms, generally supposed to be indicative of organic disease of the heart, as spitting of blood, difficulty of breathing, dropsy of the chest, abdomen, or limbs, &c., &c., she is confidently assured that she has no real heart disease whatever, and that she will probably soon be well. Or a gentleman is afflicted with dyspeptic symptoms, flatulence, constipation, heart-burn, water-brash, caprice of appetite, foul tongue, &c., &c. A careful and minute examination is instituted both by the stethoscope and manipulation into all his viscera thoracic and abdominal. The heart and lungs are found intact, the liver does not protrude below the ribs nor above the rib that should mark its upper boundary, there is no tenderness over the stomach, bowels, or bladder, the spleen is in its right place, the kidneys entire, no hypertrophy, induration or tumor is

discovered, in brief no abnormality can be detected, and the patient receives with gratified ears the pleasing intelligence that he has no disease, that is, no real disease about him, and that there is nothing to prevent his speedy recovery.

This then is the distinction usually drawn between functional and organic disease. But the author has no hesitation whatever in saying, that he does not believe in the existence of such functional disease. He does not even believe such a thing possible as that the function of an organ should be ill-accomplished without the presence of actual organic disease. If so, why does not functional disease get well? It is true that it does sometimes, but it is equally true that it sometimes does not. And organic disease also gets well sometimes. Well, but you will say, where is the disease? Shew it us, and we will acknowlege it, but our senses take no cognizance of it. I grant that, replies the author. I know the disease present is inappreciable to the gross perception of the senses, but that is no more a reason that it should not be there, than that animalcula did not exist in water before they were discovered by the microscope? Is it possible to conceive how a pendulum, once set right, should deviate from its course without a physical cause? Is it possible to conceive how a steam engine, once in full play, should cease, or alter its motion, without a physical, mechanical cause? In the same way it is equally, or more impossible, according to the author's conviction, to conceive how, in so elaborate and perfect a piece of machinery as the human system, a single organ can discharge its function imperfectly without there being something physically, mechanically wrong. From how many trivial faults, and inappreciable to all eyes but those of a watch-maker may a watch go wrong? But we never hear a watch-maker talk of functional disturbance of a watch. It would be too ridiculous. Yet it is equally ridiculous to imagine that functional derangement can

occur in the animal economy without the existence of organic disease. It may occasionally be difficult to detail its whereabout, but it is always there. Take, for example, once more, a palpitating heart. Analyse its muscular substance, which forms nearly its entire bulk, in every manner possible, physically, chemically, microscopically, and you will probably discover no disease. Carefully dissect its blood-vessels, and rigidly inspect both themselves and their contents. Still, probably, no fault will appear. But there still remains a most important subject for investigation, the nerves of the heart. These, because they are the least understood of all, require the most scrupulous attention. And here, although parts before perhaps completely overlooked, will the disease, the real disease, in all probability be located: for the heart is surrounded by an enormous quantity of most delicate nervous tissue, whose duty it is to regulate its motion, as the pendulum of a clock regulates the movements of its hands. What the precise nature of the disease may be, of course must depend upon circumstances. A cardiac nerve may be congested just in the same manner as the brain may be congested. It may be too well supplied with blood or too ill supplied. In fact, any thing may be the matter with it, as anything may be the matter with the brain, only of course on a comparatively limited scale, so limited indeed as to escape notice.

The author has at this moment a lady under his treatment who suffers from most unpleasant sensations beneath the left breast, but deeply seated. She has been an invalid many years with an uterine complaint. And although she in consequence experiences many aches, pains, and morbid feelings in different parts of the body, all of them seem eventually to terminate in some, as beforementioned, unpleasant sensation on the left side of the chest. When she first came under his care, she had suffered so much in this respect that she was convinced, in contradiction to what all her medical advisers had told her, that she laboured

under disease of the heart. The author examined the organ with the stethoscope, and then after a careful analysis of the symptoms, told his patient, that she and her previous medical attendants were both right. He then explained to her that she had not what they called disease of the heart, viz., palpable, structural change, recognisable by the naked eye, but that the nervous ganglia and plexus every where investing the organ, and presiding over its function were certainly extensively affected, so that she was perfectly correct if not in word, (although even that is doubtful) at least in idea.

And so of all other so-called functional diseases the author contends that there is no such thing, that it is a mis-nomer, that all functional disease is the result of organic disease, although this may be so concealed as to elude the gross evidence of the senses.

Considering therefore that the division of diseases into organic and functional, to be altogether arbitrary, false, and absurd, and that all disease is organic, his duty is simplified. He has merely to shew the effect of hydropathy through its influence upon the process of respiration in dissipating organic chronic disease, in other words, chronic disease generally.

Chronic disease alone is mentioned because cases of acute disease so rarely fall beneath the notice of the hydropathic physician, that it is not worth while to bring it into discussion in this place.

The author has now to propound a notion that may at first sight appear to the reader both novel and strange. He looks upon all chronic disease, of whatever class or denomination, and of however contrary natures, as consisting essentially of one of the three following conditions, namely, the existence of too much blood, or congestion of the part affected, of too little blood or anuæcia of that part, or of the supply of blood of an impure character to that part. He considers that all diseases, whether of nerves,

blood-vessels, skin, internal viscera, muscles, or bones, are all to be referred to one of these three conditions. The part diseased is over-supplied with blood, is deficient in that vital fluid, or receives to nourish it, blood whose bad qualities render it incapable of performing that office, or even affect it poisonously. The nature of the work forbids explanation upon this point, or it would be easy to prove the author's position in every individual malady. He must therefore be contented to request the lay reader to be satisfied with what he has already said upon the subject. And, for the medical reader, he will merely cite a few examples, without explanation, from the most common diseases. Apoplexy depends generally more or less upon congestion of the brain; syncope upon anæucia of the brain; dyspepsia upon congestion of the liver and stomach; constipation upon debility, that is, aneucia of the muscular coat of the bowels; Bright's disease upon congestion of the kidney; nervousness upon congestion, sometimes, but generally upon anæucia of the whole nervous system; jaundice upon obstruction from congestion of the liver; gout upon a poisonous superabundance of uric acid in the blood; rickets, and a whole host of other strumous affections upon general deficiency of blood; scrofulous tubercle, and cancerous deposit upon a venomous property in the blood. In fact, the only kind of disease that would offer any primâ facie difficulty to the reception of this view would be spasmodic diseases, such as St. Vitus' dance, epileptic and hysterical fits, asthma, hooping cough, and others. And here the author would enquire if any of his readers, medical or lay, is aware to what source these diseases can be traced. Hitherto their origin has been involved, and still is involved, in the profoundest mystery. Now, in his own mind, he entertains not the slightest doubt that some fault in their nutrition is at the bottom of the mischief; that some, probably very trivial, congestion, or lack of sufficient blood, or supply of impure blood at some part of the nervous system (whether brain,

spinal cord, or single nerve, varies of course according to circumstances), is the real cause of the disease, at all events, we *know* that congestion of the brain, that anæucia of the brain, and that a poison circulating through the brain, after either inhalation or imbibation, will induce a fit of convulsions. That we see daily.

With perfect fairness, therefore, spasmodic diseases also may be referred to one of the three states before mentioned for their origin; and neuralgic pain, or tic, is certainly attributable to the same causes.

The question, therefore, now to be decided is this; is hydropathy, through its influence upon the process of respiration, capable of overcoming congestion, of furnishing more blood in a deficiency, and of remedying a vitiated state of that fluid? Let these matters be discussed seriatim. To begin with congestion, what is the meaning of this term? Congestion, implies the presence of an abnormally large amount of blood; its immediate cause is to be found in the blood-vessels of the part affected. For some reason or other their contractile coats are ill nourished; they become weak in consequence, and lose their natural elasticity: distension follows, caused by the pressure of the blood within being now unresisted by the vascular walls; this bulging, of course, permits the ingress of more blood than could before be contained in the same space; besides this, the current of blood is deprived of that onward impetus, which was before bestowed upon it by the constant pressure of the elastic coats. Its course, therefore, is virtually impeded, so that, in addition to there being more fluid admitted into the vessels, there is also a tendency to stagnation. And all this misery arises immediately from the fact of the vascular coats being weakened and losing their elasticity from a scanty supply of nourishment, that is, of nutrient blood. The only method, therefore, of curing this congestion effectually and permanently, is to bring an abundant supply of good blood to restore their vigour and elasticity to the blood-vessels.

To the superficial reasoner, or indeed to any one not conversant with the subject, it may, at first sight, appear inconsistent, when there is distinct evidence of the existence of too much blood in any individual part, to hold out as a means of curing such superabundance the further addition of blood. But even at this superficial view it can be no more heterodox treatment, than the adoption of a plan put in force nearly every day by nearly every person, namely, the abstraction of blood, for local congestion, in an invalid whose whole system is already drained of that fluid. Yet this practice, the application of leeches, or of the cupping-glass, to a sick man for a local cause, whose general system cannot spare a single drop, is one of which not a soul for an instant doubts the propriety. But, in point of fact, without having recourse to analogy, in reference to the first subject, viz. the supply of additional blood to the body, to cure a congestion, that is, a local superabundance, a full comprehension of the modus operandi is insured by the above-mentioned theory, and that theory is well supported by experience.

Now exaltation of the process of respiration, by whatever means, effects this additional supply of blood; and hydropathy exalts that function, increasing, as it does, both the rapidity and depth of breathing. The more frequently a man breathes, the more atmospheric oxygen is inhaled, and passes into the blood, through the lining membrane of the air-cells. As before explained, the more oxygen that is conveyed to the periphery, or rather to the whole substance of the body in the blood, the more actively go on those chemical changes in the tissues, which are preparatory to the expulsion of worn out, effœte materials, and which give rise to the evolution of animal heat. The more energetically these chemical decompositions take place, of course the more abundantly is old tissue cast off, and ultimately expelled from the body, and the more speedy the consequent desire for a new supply of fresh tissue. This

can only be contributed through the digestive organs, so that thus an appetite is created. But the appetite which probably was altogether absent, or at least ailing and capricious before, is no sooner felt, than gratified. And in this way new materials enter copiously into the body, capable of becoming manufactured by an elaborate machinery into good nourishing blood. A part of this of course finds its way to the debilitated coats of blood-vessels, the seat of congestion. The vascular tunics, in consequence, become re-invigorated, and regain their elasticity ; on account of recovering this property, they contract and close upon their stagnating contents. The slow current is urged forward, the congestion gradually disappears, and health is re-established.

We have now seen the effect of exalted respiration in removing ordinary congestive diseases. But there is another kind of congestion, a sort of acute, inflammatory congestion. The first comes under the denomination of passive, the latter of active, congestion. As this affection is more nearly allied to acute, than to chronic disease, no further notice of it will be here admissible, as chronic maladies alone are the subject of the present discussion.

The next cause of chronic disease, and a most universal one it is, is, according to the preceding classification, a deficiency of blood, or which is the same thing, an impoverished or watery state of that fluid, producing, as it does, of course, a deficiency of its essential ingredients. The most important of these ingredients are the red globules, fibrine, or, as it is called under certain circumstances, plastic lymph, and albumen, that substance which, present in an egg, is called the white-of-egg. The red globules discharge the office of conveying oxygen from the air-cells of the lungs, where it enters, to the tissues spread over the entire body. They may be looked upon as so many minute carts or waggons, perpetually running between the lungs and tissues, laden on one journey with oxygen, and on the

other with carbonic acid gas,—the oxygen to help to pull down used-up structures, the carbonic acid, the result of the union of the oxygen with the worn out material, to be expelled into the air through the pulmonary membrane. The colouring matter of the blood is located in these little spheres.

The fibrine, or coagulable lymph, is that part of the blood which, when a person is phlebotomized, and the extracted fluid allowed to stand in an open vessel, forms the floating coagulum or clot. It is tinged, of course, by the mechanical adherence of some red particles to its substance. It is out of the fibrine of the blood that muscles and many other solid parts of the body are manufactured. Its importance, therefore, in contributing to the integrity of the vital fluid can no more be questioned than that of the globular red particles.

After the fibrine has spontaneously separated from the rest of the liquid in an open vessel containing blood, if the liquid residue be submitted to the application of heat, another coagulum will be formed. This is albumen, and of it many parts of the frame, especially the cerebro-spinal system, and ligamentous tissues, are fabricated.

Now when these essential constituents of the blood are deficient, just as much as when the whole quantity of that fluid is abnormally small, is the invalid said to labour under anæmia. Does accelerated respiration, brought about as it is by hydropathic appliances, tend to restore these ingredients to their normal quantity? Most assuredly, for has it not been shewn that increased breathing both imparts, when absent, and improves, when indifferent, the appetite, and consequent ingestion of food? And, since they depend for their existence upon the matters taken into the stomach, must it not inevitably follow that the more food received into the body, cœteris paribus, there must be a corresponding increase in the essential ingredients of the blood? And in this way in truth is anæmia

both when consisting of a really diminished quantity of blood, and when of an impoverished condition of that fluid, permanently cured.

It only remains now to speak of those diseases that arise from an impure or poisonous state of the blood. Gout may be taken as a specimen of disease of this pathological condition. The nature of gout essentially is the existence in the blood of an acid in great abundance, called uric acid. If this abnormal substance were to continue for any length of period increasing in the blood, it would unquestionably impart such a poisonous property to that vital fluid, as to become fatal to life. Nature, therefore, endeavours to throw it out of the system through the medium of the different articulations. This remedial effort constitutes a fit of the gout, and the joint most usually selected for this purpose is that which unites the great toe to the bone of the foot immediately above. Now it necessarily follows, that however much an acute attack may be ameliorated by remedial measures, the only way to *cure* gout, to eradicate it from the system, is to destroy the uric acid in the blood, and having done so, to prevent its re-formation, in other words, to purify the blood and maintain it in a state of purity. And what so capable of doing this both effectually and permanently, as the invigoration of that process which imports oxygen into the system, which aërates the blood, which regulates the chemical action in the tissues, upon which, in fact, depends the due performance of all the vital functions? Increased power, therefore, of the respiratory process, beyond a doubt, is the thing calculated not only to eradicate the poison of gout, but to cure all the other maladies arising from the presence of impurities in the blood.

Thus, then, it appears that hydropathy, through the influence it exerts upon the lungs, is capable of producing a beneficial effect, at least in all chronic diseases. And such a point of fact the author firmly believes to be the case.

Even in those affections which are no more curable by hydropathy than by any other system of remedial agency, he certainly thinks that patients will leave a cold water establishment in a fundamentally better state of health than they enjoyed on their entry therein. Although the local disease, perhaps some tumor, it may be even cancerous, or scrofulous, be not removed, nor at all likely to be removed, still so much benefit is usually conferred upon the general health, in the shape of increased vigor, mental and physical, improved appetite, and rectified secretions,, that the patient does not repent his hydropathic sojourn.

The author has now cursorily described a few of the happy results that follow improvement in the process of respiration. Such improvement is proved in the ensuing experiments to attend upon the various hydropathic applications.

In the last paragraph but one, the author has striven to shew how hydropathy may be beneficial in nearly all chronic diseases, of however dissimilar pathological character, through its influence upon the respiration. Lest it should appear to some sceptically inclined that there is a little over-straining in this matter, he would beg permission to support this argument by the brief introduction of another. He would premise, however, that among those thoroughly conversant with the subject, the fact is unquestioned.

Let the reader kindly picture to himself, if possible in this civilized world of ours, a man in perfect health, at all events in the enjoyment of so much as is commonly called good health. It is to be supposed that every one is blessed with this happy condition at some period of his life, however early, with the exception of a few miserable creatures that are born diseased. Now, when a person is once healthy, how does he become unhealthy? What is it that permits the ingress of disease? Be it remembered that chronic disease alone is to be taken into account. When,

then, does this disease find admittance into the system? What is the *origin* of dyspepsia? In what manner does congestion of the brain commence? How does the kidney degenerate into that peculiar state christened after Dr. Bright? Why do the bowels cease to perform their function? Do all these evils spring up of themselves, without any other recognizable cause? Certainly not. It is impossible it should be so. When the human machinery is in perfect order, it is quite impossible to understand how it should become disarranged without some independent external agency. The seeds of consumption will grow spontaneously, when placed in a fit receptacle, but they must first be sown.

Let us now inquire into those matters which are capable of exerting an influence, beneficial or deleterious, upon the animal economy from without, that is independent of the animal economy. It will be found that certain organs are exposed to external impressions, and that certain others are not so, (except of course secondarily through the medium of the first). Those organs that are subject to external impressions may be enumerated as follows: 1. The gastro-intestinal mucous membrane, consisting of the mouth, esophagus, stomach, small and large bowels. 2. The mucous membrane of the air-passages containing the larynx, the trachea or windpipe, the bronchial tubes, and the air-cells of the lungs. 3. The cutaneous membrane, or as it may be called, the external mucous membrane. 4. The brain. 5. The organs of propagation. The viscera, that may be said to be *not* primarily susceptible to external influence are, 1. The heart. 2. The Liver. 3. The kidneys. 4. The spleen. 5. The pancreas. 6. The bladder. The first series of organs are very much under our own control. The second are totally independent of us. The consequence is, that we can and do abuse the former very frequently in a straightforward manner. The latter suffer only indirectly. And the author has not the slightest ti-

midity in avowing that disease first enters the body through some gate found open in one or more of the first five organs—that internal disease of whatever kind, and where-ever located is invariably the result of some morbid impression made upon one or more of these five organs from without. Nor are even hereditary affections, or any specific maladies, as miasmatic or contagious disorders, any exception to this general, nay, universal principle.

The mode in which such morbid impressions may be, and are daily made upon the system by the medium of the organs before-mentioned, as susceptible of external influences, is easily enough understood. Let us begin with the one placed first on the list, namely the gastro-intestinal mucous membrane. This long tract of surface lining the interior of the mouth, throat, esophagus or gullet, and stomach, the three small bowels, viz. the duodenum, ilium, and jejunum, and the three large bowels, viz. the cœcum, colon, and rectum carries on the digestive department of the animal functions. In the mouth the food is received and masticated. In the stomach it is tristurated with the aid of the gastric juice, till it is converted into a grey pulpy mass, called chyle. In the duodenum this mass comes in contact with the secretion of the liver, the bile, which separates it into two portions, the nutritious chyle, and the non-nutritious residue. Along the whole length of the small bowels are ranged a number of microscopically minute hollow organs, called lacteals, through whose fine, attenuated investing membrane this chyle penetrates to be carried by vessels, called lymphatics or absorbents, into the veins. It is then carried by the current of the blood, venous blood of course, to the lungs, where it is aërated, and rendered fit for the fabrication of human tissue. The innutritious residue passes along the small bowels into the large ones. It there mixes with certain local secretions, and the mixture constitutes what is finally expelled. From this it plainly appears that anything taken into the

mouth of an irritating nature is capable of irritating all these parts engaged in the process of digestion, and directly and deleteriously affecting the correct discharge of their functions. In this way unwholesome articles of food, as well as food in too hot or too cold a state, also irregularity in taking sustenance, sometimes taking too much, at other times going too long without any, for the gastro-intestinal mucous membrane suffers as much from the reception of too much or too little food, as from such as is of an unwholesome character—in this way, to repeat, all these unnatural inconsistencies produce their injurious effect. And in this way is one gate opened for the admission of disease. When once entered, his devastations may be modified in character and extent according to various casualties. And the only way to drive him out is through the same road by which he entered; namely, it is only by instituting dietetic regimen, that he can be expelled, and afterwards kept at a distance. Now, there is no one thing upon which hydropathy insists more unflinchingly than upon dietetic regimen.

Let it be borne in mind, nevertheless, that it is not intended to assert that, when disease has once got a firm hold upon several internal viscera, although it effected its entrance into the system through a dietetic error, or rather a series of dietetic errors, it can be at once and effectually expelled by abandoning those inconsistencies *merely*. Otherwise disease arising from this source might be cured by the individual leaving his pursuits and making a sojourn, say at a farm-house of primitive dietetic simplicity, without having recourse at all to hydropathic or non-hydropathic physician. But this has been proved to be insufficient. Mere correction of diet is not enough. What the author, therefore, wishes the reader to understand is this, that unless the aid of dietetic regimen be sought, or in other words, if the cause of the malady be allowed to continue in full force, all *other* treatment he may adopt will

fall to the ground useless. Let these remarks also be well remembered, when speaking of diseases admitted into the body through the other organs exposed to external influences.

The mucous membrane of the air passages is the gate, by which the obnoxious properties of impure air are imbibed into the system. It is there that various poisonous gases find admission. The most common of these is carbonic acid, which is the principal ingredient of the vapor exhaled from the lungs. Hence its abundant presence in places of public amusement, balls, concerts, &c. It is questionable however whether this gas, when present only in such quantity as not to render the air irrespirable, really enters the blood, or only acts injuriously by excluding oxygen. Pure carbonic acid gas cannot be inspired as it always causes the spasmodic closure of the top of the windpipe.

Through this pulmonary mucous membrane then the obnoxious effects of too warm an air, an impure air, &c. are manifested in the economy. And any maladies arising from the inhalation of an impure atmosphere can only be thoroughly extirpated by the substitution of a pure one. For example, if a person living in a marshy, miasmatic district, be afflicted with ague, the first prescription is to remove the patient into a dry atmosphere. Without this precaution the chances of success are but small. Now, as the hydropathist rigidly enjoins regimen in diet, so also does he maintain the absolute necessity of pure air in the vicinity of his establishment.

The third organ on the list, as susceptible of external influences, is the skin. This membrane is *the* most extensive, *one* of the most important, and *the* most complicated organ in the body. Nevertheless it is the most easily maintained in the proper discharge of its various offices, and no doubt, *therefore*, the most religiously neglected. The skin occupies so momentous a position in connexion with the

subject of hydropathy, that the author entreats permission to say a few words concerning its anatomy and physiology, even though it should appear a digression.

A man of moderate height and bulk presents a surface of two thousand, five hundred square inches. This of course therefore is the exact admeasurement of the skin. Now with regard to its anatomical construction.

However simple this membrane may appear by looking at it only with a bird's-eye-view, very many diversified elements enter into its composition. The most important of these, or at all events those which alone require mentioning here, are:—1. The papillæ, which form the residence of the sense of touch. 2. The sebacious follicles, placed there for the object of lubricating the surface. 3. The perspiratory apparatus. The papillæ are a number of minute pyramidal bodies, whose apices are perpendicular to the surface. If any of them be exposed by the removal of their protective covering, the cuticle, as by a blister or burn, acute pain is experienced. They are most abundant where the sense of touch is most acute. The pulpy surface of the extremity of the finger is therefore abundantly supplied with them. The common corn is nothing more than the hypertrophy of one of these conical papillæ, covered over with a thick layer of cuticle. "Cutting a corn" dimishes the pressure upon the tender spot caused by the boot, or anything else.

Superficial neuralgic, or tic pains may be all expressed by a fitful irritability of these neglected and ill-used organs. Ill-used, be it repeated; because this unnatural impressionability is not owing to chance, nor to the season, nor to the calumniated climate of England, but simply to the wilful neglect of those who suffer. If the victims of these aches and pains would only pay half the attention to their own health that they do to their cash accounts, or idle amusements, their penance would be unpaid, their lumbagos, rheumatisms, and tics unfelt.

The sebaceous follicles are minute crypts or blind alleys scattered all over the skin, whose office it is to secrete an oleaginous fluid for the sake of maintaining the cuticle or external integument in a constantly moist and pliable condition. It is inflammation supervening upon obstruction of these follicles that gives rise to that crop of pimples frequently so flourishing about the age of adolescence.

The perspiratory apparatus differs from the sebacious in secreting its fluid, for which there is no further use in the animal economy. The organs devoted to this object are a series of small glands pervading the whole superficies of the body, but more abundant beneath the arms than elsewhere, and made up of a convoluted tube terminating in a straight one, which discharges its contents by an open mouth on the surface of the skin like an ordinary sewer.

A philosopher, called Sanctorius, weighed himself, his food, and his excretions every day for thirty years, with the intention of ascertaining how much of the waste of the body passed off by the lungs, kidneys, bowels, and skin. He arrived at the conclusion that five-eighths of all discharged escaped through the skin.

Another philosopher of the name of Seguin, with the same object in view, performed the following ingenious experiment. He procured a perfectly air-tight bag, with which he completetly invested himself, leaving a hole to breathe through. The edges of this opening were glued to his lips, so that no perspiration could escape. By carefully weighing himself at the beginning of the experiment, and twice at the end, viz., in, and out of the bag, he ascertained first how much in weight he lost by pulmonary exhalation, and secondly how much by cutaneous secretion. His body lost on the average through both channels together eighteen grains per minute, eleven of which permeated the skin, while seven only escaped by the lungs. Eleven grains per minute are equal to thirty-three ounces per day. And it must be remembered that the whole of this loss was

by *insensible* perspiration, of which one takes no cognizance. Now if it be natural for a man to eat, say a pound and a half of food per diem, and for the skin to excrete in the same time thirty-three ounces of fluid from the body, it is as important, consistently with health, for the *whole* of that fluid to be so discharged, as it is for the whole of that food to be taken. It is perfectly true that if this, the natural passage for certain portions of the *debris* of the body, be impervious, as it too frequently is, that the kidneys will endeavour to compensate for the fault in the skin by doing double duty. But what is the consequence? The kidneys of course suffer from excess of work, and the skin from inactivity becomes still more diseased than it was before. Dr. Osborne,* a gentleman who has made kidney disease his peculiar study, declares that twenty-two cases out of thirty-six of that affection were immediately attributable to suppressed perspiration. And Dr. Christison, in his work on granular degeneration of the kidney, confirms the opinion by saying that, where his patients did not ascribe the cause of their disease to suppressed perspiration, they gave no cause at all. Who does not know that inflammation of the lungs, bowels, and brain, gout, rheumatism, and every acute disease under the sun, occasionally if not generally proceed from the same cause? Is it not therefore truly marvellous, acquainted as we are with these facts, and a clear knowledge of the necessary baneful results of their neglect staring us full in the face, that we should suffer this most vital organ to dry up like parchment, to fall into such ruinous decay as to be unfitted for its office?

Thirty-three ounces (or rather more than two pounds) of a fluid containing solid matter in solution passing out of the body through the skin daily, it follows as a matter of certainty that some portion must become concrete, and

* Osborne on Dropsies; second edition, London, 1837.

adhere to the surface. To obviate any evil consequence that might arise therefore this should of course be washed away. But if no such ablution be performed, the channels both of the sebaceous follicles, and the perspiratory glands become obstructed, the former causing the skin to become harsh, dry and brittle, and the latter giving rise to the already-mentioned injurious results of suppressed perspiration. Two of the elements of this complex structure being deleteriously affected, its other component parts soon participate in the mischief. For example the papillary or sensitive layer becomes acutely irritable, and neuralgic pains follow. There is also a wonderfully close sympathy between the skin and the digestive viscera, so that the chorus is soon swelled by the discordant voice and manifold horrors of dyspepsia. General ill health, malaise, debility, languor, now reign triumphant. The patient becomes very delicate, and susceptible of cold. More flannels are put on the body, more blankets on the bed, more fuel on the fire. He trembles when he asks which way the wind is, shudders at the mention of cold water, and in one word an affection that could have been washed away with a handful of water is about to degenerate into a serious disease. And yet how many wash their skin once a day? How many once a week? How many once a month?

One more important function of the skin, and one not to be passed over in silence, is the regulation of the animal heat. It is very well established that however much the temperature of the surrounding atmosphere may vary, that of the human body remains within a degree or two invariably the same. In our own fluctuating climate this is extremely important. For otherwise our bodies would one day be at summer heat, another at winter heat, and so on, a changeableness clearly incompatible with human life. Were it not so too, we should be necessitated to remain for ever in the climate of our birth. But on account of this innate power of maintaining undisturbed the same, and

normal temperature of the interior of the body, we can shift about from east to west, from north to south, with impunity. Captain Ross in his journey to the polar regions endured an amount of cold capable of freezing mercury, namely, forty degrees below zero. Sir Joseph Banks remained for a short time in a room whose temperature was raised fifty degrees above the point where water boils, namely, two hundred and sixty two. In this experiment either Sir Joseph or one of his companions wore a pair of spectacles, which became so hot, that the metal burnt his skin, and he was obliged to remove them. And yet neither Captain Ross nor Sir Joseph Banks experienced the slightest harm. Why? Because the heat of their internal viscera was unaffected. If it had been possible for the surrounding atmosphere to influence or alter it in any way, Captain Ross's blood would have become converted into sticks of red ice, and that of Sir J. Banks would have coagulated like a boiled egg.

The power of thus controlling and limiting the temperature of the body is vested in the skin. Every portion of fluid secreted through its pores in its passage from the fluid to the vaporous form must appropriate a large quantity of heat, thereby rendering what before was sensible latent, and obviously producing a cooling effect. Now it follows that the more fluid there is extricated from the body, the more sensible heat will be rendered insensible or latent (passing away from the body with the vapour and diffusing itself in the atmosphere), and so the greater the amount of coolness developed. And the power of secreting almost any amount of fluid, and so of abstracting any amount of heat forms one of the many functions of the skin. When, therefore, the system is exposed to great heat as on a hot summer's day, or in a tropical climate, or by great muscular exertion, so that there would otherwise be a danger of raising the temperature of the body to an abnormal elevation, and so put life in peril, the skin im-

mediately throws all her flood-gates wide open, and the refrigerating agent, in the shape of perspiration, flows out profusely. Thus all injury is prevented. So on the other hand, when the temperature of the medium in which the body is placed is gradually lowered, as by sheltering it from the hot rays of the sun, or by cessation from muscular exercise, these gates are one after another, so to speak, shut up, and the moisture exuding from the body, falls in quantity to the ordinary amount of *insensible* perspiration. This beautiful sliding-scale power with which the skin is endowed, is still more palpably exemplified in a *sudden* change of temperature. For instance, while a man is sitting over wine and dessert with his convivial friends in a heated dining room, every pore of his skin is eliminating fluid for evaporation. His entire surface feels moist. The whole of the fluid, that is extricated from his body, passes through the skin. The kidneys lie idle. This is to prevent the otherwise inevitable consequence, fever. And in this state of artificial excitement, the result of civilization, and the march of intellect, while his stomach is being fretted and irritated by the perpetual droppings of wine into its cavity, over-burthened as it already is by the soup, fish, flesh, and pastry, while the wordy war on politics, literature, or ballet-dancers is exciting his brain, the whole heightened by the glare and heat of fire and candles—where in one word *actual fever* would be lighted up as an inevitable consequence, the good skin is industriously and untiringly at work to counteract these evil proceedings and prevent the threatened mischief. Let now such a person suddenly emerge from such a state of things into the cold air. He is forthwith in as much danger from the contrary extreme. If his skin continued secreting largely as before, the reaction from his previous over-stimulated or febrile condition would kill him outright, because it would be aided by the evaporation from the surface. But what occurs? The skin instantly shuts up all her hitherto open

orifices. Superficial evaporation is at once stopped; and thereby an immense amount of animal heat, that would otherwise have been dispersed, is retained within the body. But there is now another danger of great magnitude to be apprehended. It is this. Whenever a copious discharge of any kind from the body is suddenly interrupted, considerable peril is incurred from a fear of the blood being diverted in large quantities from the part, whence the discharge had issued, to some internal and vital organ incapable of separating it from the body, as the lungs, heart, or liver. In such cases most serious mischief is to be dreaded. How, then, in the instance just described is such an evil obviated? Most easily. The kidneys, whose functions in the hot dining-room were suspended to accommodate the skin, now in the cold air resume their duties. The same quantity of fluid escapes as before, but through a different channel. And although evaporation follows its emission, it does not occur on the skin, so that no cooling effect on the body is produced.

It will now be easily conceived, to speak paradoxically, how inconceivably important to life is this heat-regulating principle, with whose administration the skin is entrusted. And moreover it appears to the author that the reader must agree with him, that an organ deemed worthy to receive so high and vital a trust should be treated with preeminent consideration, and shielded from danger with the most scrupulous care.

It has been already stated that when any habitual discharge from the body receives a check, or is altogether obstructed, the current of blood that had been determined to the part, whence the flux had issued, and which was necessary to maintain it in activity, is diverted from its course, and being thus diverted must invade some other part of the body. An excellent example of this occurs in vicarious menstruation. In this case the blood, that should pour itself into the tissue of the womb, being from

some cause or other refused admission into that organ, finds its way into some other, as the lungs, stomach, or nose. Under these circumstances hæmorrhage from any of these viscera is no uncommon occurrence. The same thing takes place when the perspiration is obstructed. But, generally speaking, it luckily happens that those very organs that are by nature the best adapted to undertake this supplementary action, and perform the skin's duty, are those upon which it for the most part falls, to wit, the kidneys. As a general rule, perhaps, no great harm results from this arrangement. But if from any cause, as from recent debility, or constitutional delicacy, the kidneys be incompetent to accomplish the extra duty, disease of those viscera is the inevitable consequence. And then the only mode of effectively treating such disease, is at once to strike at the root of the evil, to withdraw from the labouring kidneys their unnatural burden, and restore to the skin its proper secretion. Hydropathy does this.

Sometimes in obstructed perspiration the unwelcome charge of carrying on its office falls to the lot of the mucous membrane of the intestinal canal, and a *diarrhœa* is the result. In such case there is the same obvious method of cure as in the instance last mentioned, viz., to restore the proper secretion to the skin, thus diverting the flow of blood from the bowels. And hydropathy does this.

The blood instead of being determined to the intestinal portion of the mucous membrane, may invest the gastric portion, the stomach. Nausea, vomiting, heartburn, acidity, water-brash, and a long array of dyspeptic annoyances supervene. In such an example your medicinal armament is of no avail. Nothing will materially benefit the patient, but efficiently restoring to the skin its proper secretion, and it is hydropathy alone that does this.

Lastly, the internal irritation arising from deficient or absent action in the skin may manifest itself in the lungs, and cough, difficulty in respiration, expectoration, and in

bad cases many of the symptoms of pulmonary consumption itself are developed. Indeed there seems to be a very strong link between actual consumption, and want of energy in the cutaneous circulation and secretion, and symptoms of inactivity of the latter, including cold feet and hands, general chilliness and susceptibility to take cold, so commonly precede the manifestation of the former, that the author is not sure they do not very frequently bear the relation to each other of cause and effect. At all events in the early stages of consumption the only possible hope of effecting a cure is through the medium of the skin. It is by influencing the cutaneous functions that riding, and sailing, friction, and emetics have each acquired their supporters in the treatment of this English scourge. Speaking of the efficacy of sailing in incipient consumption Dr. Andrew Combe details his own case in the following words:

"The writer of these remarks became ill in the month of January, 1820, and soon presented many of the symptoms of pulmonary consumption. In spite of the best advice, he continued losing ground till the month of July, when he went by sea to London on his way to the south of France; but finding himself unable for the journey, he was obliged to return from London, also by sea. Being extremely liable to sea-sickness, he was squeamish or sick during the whole of both voyages—so much so as to be in a state of gentle perspiration for a great part of the time. After this he became sensible for the first time of a slight improvement in his health and strength, and of a diminution of febrile excitement. Some weeks afterwards he embarked for the Mediterranean, and encountered a succession of storms for the first four weeks, two of which were spent in the month of November in the Bay of Biscay in a very heavy sea. For more than three weeks he was generally very sick, and always in a state of nausea; and during the whole time, although his bed was repeatedly partially wetted by salt water, and the weather cold, *the*

flow of blood towards the skin was so powerful as to keep it generally warm, always moist, and often wet with perspiration, forced out by retching and nausea. The result was that on entering the Mediterranean at the end of a month, and there meeting fine weather, he found himself, though still more reduced in flesh and very weak, in every other respect decidedly improved; and on his arrival in Italy at the end of seven weeks recovery fairly commenced, after about ten months illness; and by great care it went on with little interruption, till the summer of 1821, when he returned home."

It is manifest in this case Dr. Combe ascribed his incipient consumption to a sluggish state of his cutaneous circulation, and consequent deficient perspiration, and attributes his cure to their restoration. And as a general rule what remedy so efficient to produce this happy effect as the hydropathic treatment?

One more word on the skin, and the action of hydropathy upon that membrane. The blood in its never-ceasing progressive movement from the heart and lungs, (in which latter organs it has undergone the purifying process of decarbonization) to the periphery of the body, permeating in its course and repairing all the various tissues, passes perpetually *from larger vessels into smaller ones*, till it arrives at those minute hair-like tubes called capillaries. It is in these delicate canals, or rather outside their walls, that the process of formation and demolition, or in one word repairing of the body, is executed. Healthy, rosy, arterial blood, fresh from the lungs, exudes *out of* them. Its fibrine is deposited as good, new, solid tissue, while its oxygen uniting with bad, old, worn-out tissue, exudes back again *into* them, imparting to it the dark colour of venous or impure blood. This fluid now, contaminated as it is, proceeds onwards in its circulating motion to the part from whence it came, the heart and lungs, to be again submitted to the process of purification. And while moving in this

direction, having thus abandoned the arteries for the veins, it is perpetually passing from *smaller vessels into larger ones.* Now this passage, firstly, from large into smaller channels (in the arteries), and, secondly, from small channels into large (in the veins), is calculated to throw considerable impediment in its course, the former from the increasing amount of friction, the latter from the tendency to stagnation acquired by every fluid emerging from a confined into an open space. Having to contend against such obstructions blocking up its path, it follows that to make its way effectually through them, there must be a powerful *vis a tergo.* Such a *vis a tergo* every one who has the slightest conception of what he is made, knows to exist in that hollow muscle, the heart, and in the elastic, contractile walls of the arteries. But every one does not know that there is another organ, besides the heart and arteries, that performs most efficient service in aiding to maintain the regularity of the circulation. This organ is the skin, and its medium of action is the perspiration. The important duty alluded to is executed after this manner.

"Nature abhors a vacuum," that is, whenever in any given space there is a tendency to the formation of a vacuum, in the surrounding atmosphere there is always a tendency to prevent it by rushing in, and taking the place of the dissipated air. A *perfect vacuum* has never yet been produced even by artificial contrivances of a chemical or mechanical nature. But without the aid of art, not even the *partial vacuum,* commonly called a *vacuum,* ever exists for an appreciable length of time. And the greater the tendency to a vacuum, the greater the tendency of the circumambient atmosphere to occupy the would-be void.

In a room where there is a fire and a door, there is always a draught between them, that is, a current of air passing from the latter to the former. The heat of the fire rarifies the air in the chimney, and *would* soon generate a vacuum therein, but that a new supply is immediately

obtained from the room. This causes the same disposition to a vacuum there, which is prevented by a rush of air through the crevices round the door inwards.

All these phenomena are displayed in precisely the same manner and order in the human skin. Perspiration exudes through the coats of a capillary. Instantly there is a tendency to the formation of a vacuum in the interior of the vessel. Instantly this tendency is counteracted by a rush of blood from behind. More perspiration escapes. Again a vacuum *would* be formed, but that more blood hurries to the spot. In this manner then the circulating fluid receives an impetus, not only from a *vis a tergo,* but also from a *vis a fronte.* And in this manner blood is determined *to* the skin, *to* the periphery of the body, *from* the interior, *from* the large vessels and vital organs.

The organs of circulation, therefore, are the heart, the elastic coats of the arteries, and the skin. Which is the most important? In an El Dorado state they would no doubt be exactly equal in this respect in the animal economy. But inasmuch as the two first go through their evolutions quite independently of all volitional control, whereas the function of the last may be influenced in regularity and power very much by ourselves at pleasure, and we are not slow to take advantage of this to our own detriment, it seems to the author that a study of the last is of far the greatest moment. So that in addition to the host of other evils curtailed upon our unfortunate bodies by a neglect of this most important membrane is that of depriving the blood of one out of three of its organs of circulation. And hydropathy, exercising as it does a direct influence upon the skin, must exercise also an indirect influence upon the circulation, and upon diseases of the circulation.

The fourth organ that is directly susceptible to the influence of external objects, and therefore opens a fourth gate to the approach of disease, is the brain. This is the ma-

terial organ of the mind, and is entrusted with the office of transmitting to the body the mandates of the will. It is the seat of emotion, thought, perception, and all mental and moral faculties. And on this account it holds a much more exalted position than any other part of the body.

As the muscular system to be maintained in health, requires a regimen of exercise, so also is it necessary duly to regulate the exercise of the brain, to insure the correct performance of its functions. And as by want of employment muscles become weakened and emaciated, bones lose their hardness and bend, and blood-vessels degenerate into solid cords, so does the brain by mental inactivity lose its intellectual vigor, and relapse into imbecility. But the resemblance extends still farther. For as by violent, overstraining efforts, a muscle may be torn, an artery burst, a bone snapped asunder, so by imposing upon the brain too much mental labour, the delicate structure of that organ may suffer with great severity.

Whenever a person labours under considerable mental excitement, an unusual quantity of blood flows into the brain. This can be proved in many ways. But it will be sufficient to relate the following illustrative case. It occurred to Dr. Pierquin at the hospital of Montpellier in the year 1821, and is reported by Dr. Caldwell in his "Annals of Phrenology," in these words. "The subject of it was a female at the age of twenty-six, who had lost a large portion of her scalp, skull-bone, and dura-mater in a neglected attack of lues venerea. A corresponding portion of her brain was consequently bare, and subject to inspection. When she was in a dreamless sleep, her brain was motionless and lay within the cranium. When her sleep was imperfect and she was agitated by dreams, her brain moved, and protruded without the cranium, forming cerebral hernia. In *vivid* dreams, reported as seen by herself, the protrusion was considerable; and when she was perfectly awake, especially if engaged in *active thought*

and *sprightly conversation,* it was still greater." From this and many similar cases the inference appears indisputable, that the more intensely the mind is occupied, the greater is the rush of blood to the head. This is sometimes carried to such an extent in public speaking, where the mental excitement occasionally knows no limit, that the brain has yielded to the engorgement, and the orator been suddenly stricken with apoplexy.

This determination of blood to the brain, if the emotional excitement that produced it pass away in a short time, inflicts no injury. But if the cause be continued, the force of the cerebral circulation may become so energetic as to occasion the laceration of a blood-vessel. The consequence of this of course is most serious. Effusion of blood into the tissue of the brain occurs, and an apoplectic fit is the result. But far more generally the increased rapidity and force of the cerebral circulation relapses into a chronic congestion of that organ. Every day we see this well exemplified in that most valuable class of men the commercial community. They very often devote themselves with such application to their avocations, that they live in a state of constant anxiety. But it is incorrect to limit this state of things to any one class in the present day. For at this moment there seems to be but one object, that all classes and individuals are endeavouring to reach. That is the accumulation of wealth. Every one is striving to make a fortune. As if that were the aim of existence. As though we were put into the world to amass a heap of money! A truly paltry pursuit, and this age, which may be called the age of £. s. d., a truly contemptible one! But such being the actual state of things, there is no help for it. It is futile railing against it. If men will rack their brains for the means of gaining in the shortest time the longest purse, those brains will become congested. But let me not be thought too sweeping in my observations. Although this results most frequently from

the feverish excitement attendant upon money-making, still it does occur of course to any one devoted to too much head-work, and sedentary habits. Thus the university student, the literary man, &c. &c., are often the victims of this complaint.

Unnaturally precocious intellect in children is decidedly bad. It is almost a certain sign, if the precocity be very marked, of a scrofulous constitution. At all events in the heads of those children, whose premature mental development distinguishes them from their playfellows, there is always considerable vascular excitement. If this vascular excitement be by judicious means overcome, all may yet go well. But if it continue to increase, it will probably terminate in one of these two ways, namely, either in the production of "water on the brain," or in the deposition of scrofulous tubercle in the cerebral substance. Yet how frequently do ignorant parents by encouraging the forward intellect of their offspring do all they possibly can to foster this excitement, and induce these fatal maladies!

Nor, when the brain is diseased, are the morbid effects necessarily confined to that organ itself. For by means of the nerves that pass from it to every part of the body, it is capable of exciting disease elsewhere in a hitherto healthy locality. And this is frequently the case with congestion of the brain. The symptoms are not merely those which arise from cerebral disturbance, but often such as are associated with disordered digestive viscera. Hence indications of disturbance of the liver and stomach generally accompany those of a labouring brain.

The only method of curing these various cerebral affections, or other diseases depending upon a cerebral affection, is to remove the cause of the excitement of the brain. For example, if a person's brain suffer from too close an application to business, he must at all events for a time suspend his business pursuits. If a child evince unnaturally precocious book-learning, let his books be

locked up, and himself sent into the fields to play. By no means let his fondness for reading be cultivated. When dyspeptic symptoms supervene upon this taxation of the brain, they will never be eradicated, unless that tax be first repealed.

In disorders of the brain, therefore, hydropathic principles are of invaluable service. For they always insist upon immunity of the brain from every source of anxiety, from all conceivable forms of mental excitement. Not even reading is encouraged, unless it be works of the very lightest description. A total relaxation of the brain is enjoined. A continuance of business pursuits is of course always out of the question, at all events in any affection of the head.

The fifth and only remaining part, through which disease finds an entrance into the body, is the organs of propagation. A very few words on this subject will suffice. It not unfrequently happens that much debility and malaise owe their origin to too strong an attachment between married persons. And very often indeed the same circumstance prevents the recovery of either party, when labouring under any complaint, as dyspepsia, or what not. Of course there is but one way to cure this malaise and remove this obstacle to convalescence. And it is an invariable hydropathic rule that, whichever is the invalid, a temporary separation be enforced. This, by the way, is a secret which alone is capable of effecting many important cures. It is most essential to insist upon this disunion in all cases of general debility, nervousness, dyspepsia, and hypochondriasis of both the male and female sex. It is equally indispensable in all kinds of diseases connected with the womb, all hysterical affections, &c. &c.

An immense amount of evil is incurred also by certain specific maladies. But although a most important subject, this is not the place to discuss it.

It has now been seen that disease gains an entrance into

the human system through five channels, namely, the gastro-intestinal canal, the air-passages, the skin, the brain, and the organs of propagation—that to effect a radical cure in any disease whatever, dietetic regimen, the inhalation of pure air, the maintenance in proper order of the functions of the skin, the abstraction of the brain from the excitement of any pursuit inducing great mental anxiety, and lastly, a temporary conjugal separation must be considered as indispensable aids And these five salutary regulations are immediately put in force as soon as an invalid, whatever be the nature of his malady, passes the door of a hydropathic establishment. Is it then a matter of surprise that hydropathy should be capable of curing all curable diseases, and of relieving many that are incurable?

Before concluding the author begs permission to say one more word. It may strike the reader that some important baths are not mentioned in the following researches. In explanation the author begs to state that those only are not mentioned whose physiological action upon the human system so nearly resembles others that are mentioned, that their description would have been an encumbrance. Of this kind are the "dripping-sheet," the "can-douche," the "wash-down," &c. These approach very strongly in resemblance as to their effects upon the body to the "shallow bath," upon which, it will be seen, many experiments have been made.

Having now prepared the reader for certain results that he is to expect, the author trusts he will be more able to recognize and appreciate them in the researches that follow.

CHAPTER II.

THE WET-SHEET PACKING.

Before presenting to the reader the following cases, which for the sake of clearness and precision have been arranged in a tabular form, it will be necessary to make a few explanatory remarks.

The first six operations were performed on a young man 5 feet 4 inches high, twenty years of age, and 8 stones in weight. His fair complexion, habitually quick pulse, hurried respiration and other circumstances, stamped him with the sanguine or excitable constitution.

The three last operations were undertaken by a man of a totally opposite character. He was twenty-eight years old, weighed ten stones and a half, stood five feet ten inches, and was a perfect example of the bilious or phlegmatic diathesis. Two men of such opposite temperaments were well-adapted to counterbalance each other.

As in the following operations it would be impossible to examine the pulse at the wrist after the commencement of the process of packing, the temporal artery was substituted, which for the information of the non-medical reader, it may be well to mention, is an arterial blood-vessel beating in the temple, and precisely analagous in every respect to the one beating in the arm.

The number of respirations (consisting of *in*spiration and *ex*piration) were counted sometimes by listening to an audible murmur in the breathing, and sometimes by feeling with the hand the rising and falling of the chest.

The expression "immediately after" means immediately after the first envelopement of the body by the wet-sheet, and not after the termination of the process of packing.

So with regard to the ensuing expressions "ten minutes after," &c.

By "In shallow bath" it is to be understood that the bather has been removed from the wet-sheet, and placed in a shallow-bath containing fifteen gallons of water, in which latter he has been rubbed for one minute.

The expression "In drying sheet" denotes that he has emerged from the shallow-bath, and been enveloped in the dry sheet, in which also now he has been rubbed one minute.

The temperature of the sheet was ascertained by enclosing therein a thermometer, cautiously preventing contact with the skin.

The operations were all conducted in the forenoon, commencing at Nine o'clock.

FIRST SERIES OF OPERATIONS PERFORMED ON AN EXCITABLE TEMPERAMENT.

Operation I.

Of One Hour's duration.

	Pulse per minute.		Respiration per minute.	
Before the process	104	......	24	
Immediately after.	84	......	32	
10 minutes after...	76	......	28	feels warm all over.
20 minutes after...	72	......	24	
30 minutes after...	66	......	24	still warm, and continu-
60 minutes after...	60	......	22	ing so during the rest
In shallow bath ...	72	......	24	of the operation.
In drying-sheet ...	88	......	28	

Temperature of the wet-sheet, which was still wet and steaming, 93° F.

Temperature of the water in the shallow-bath raised from 48.50° F. to 49.25° F.

	st.	lb.	oz.
Weight prior to the operation...........	8	0	$6\frac{1}{4}$
Weight subsequent to the operation ...	8	0	$5\frac{1}{4}$
Loss......			1oz.

In this experiment it will be perceived, that on bringing the body in contact with the wet-sheet the pulse at once fell 20 beats in the minute, nearly $\frac{1}{5}$ of its whole number of pulsations. It then for the space of one hour, that is the whole period of the envelopement, continued gradually sinking till it counted only 60 strokes, being rather more than $\frac{2}{5}$ less rapid than it was before the process.

By adding together the numbers 84, 76, 72, 66 and 60, and dividing the whole by 5, viz., the number of times the pulse was felt, an average rapidity of pulse per minute for the whole period of the packing may be obtained. But it will not be a correct one, since at the end of forty, and of 50 minutes, the state of the pulse was not ascertained, in the first place, because to do so would have required more time than the author's manifold engagements would have permitted him to devote to the experiment, and in the second place because it was not absolutely necessary, since the same accurate precision can be and is obtained by a mode of calculation which he will lay before the reader. If we consider, as we fairly may, that at those two periods the pulsations were respectively 64 and 62, (the foregoing being 66 and the following 60) and then add them to the five above-mentioned figures, and divide the total by seven, we shall obtain the result 69.14. This may be regarded as a fair estimate of the average rapidity of the pulse during this operation, while lying in the wet-sheet. The only method of acquiring *perfect* accuracy would be to have the finger on the pulse the whole time.

By the application of the wet-sheet therefore the pulse subsided from 104 to 69.14 per minute, being a fall of no less than 34.86 beats.

In the shallow-bath after one minute it had risen 12 beats, and after one minute's rubbing in *the sheet* 16 beats more, reaching then 88, but being still 16 degrees under the original number.

With regard to the function of respiration precisely the opposite effects occurred. Before the process was commenced the man breathed 24 times in a minute. Immediately on the application of the wet-sheet, when the pulse *fell* $\frac{1}{5}$ the respiration *rose* $\frac{1}{3}$! becoming 32 instead of 24. It now however began to sink, and continued to do so till the end of the process. But even then, when the pulse had fallen more than $\frac{2}{5}$, the respiration had decreased only by $\frac{2}{24}$, being 22 instead of 24. If now the figures 32, 28, 24, 24, and 22, with the insertion of 23 twice (as the estimated number of respirations that belong to the respective periods of 40, and 50 minutes after the commencement of the process, omitted as mentioned in reference to the pulse) being the intermediate number between 24 preceding, and the 22 following, be added together, we shall arrive at the number 176. Divide this by seven, and the average amount of respirations per minute of the whole hour during which the packing lasted, will be the result. And $176 \div 7 = 25.14$, indicating an actual elevation in the rapidity of respiration of 1.14 per minute.

While therefore there was a *decrease* in the beats of the pulse per minute of 34.86, there was an *increase* in the beats of the lungs, if such an expression may be employed, of 1.14. Now before the commencement of the packing the pulse had been 104, and the respiration 24. These figures then may be taken as expressing the due relation between the lungs and the heart. But as 104 : 24 :: 69.14 : 15.95. So that the pulse having subsided from 104 to 69.14, so also cœteris paribus ought the respiration to have fallen from 24 to 15.95, whereas on the contrary as the pulse fell below the standard, the respiration rose above it. *Quod erat demonstrandum.* Vide introductory chapter, and analysis of the wet-sheet operations.

In the shallow bath, and after five minutes' rubbing in the dry sheet the respiration rose at the same time as the circulation or pulse.

Operation II,

Of one hour's duration.

	Pulse, per minute.		Respiration, per minute.	
Before process......	100	......	24	
Immediately after.	72	......	36	
10 minutes after ...	72	......	28	feels warm and comfortable, and continues so during the operation.
20 minutes after ...	69	......	27	
30 minutes after ...	64	......	18.5	
60 minutes after ...	60	......	19	
In shallow-bath ...	64	......	24	
In drying-sheet ...	72	......	28	

Temperature of the wet-sheet, still wet and steaming, 91° F.

Temperature of the water of the shallow bath raised from 52° F. to 52.75° F.

	st.	lb.	oz.
Weight prior to the operation...........	8	0	0¾
Weight subsequent to the operation ...	8	0	0
Loss......			¾oz.

Between this operation and the preceding one in their main features there is the most striking resemblance.

In the first place in reference to the pulse there is the same sudden subsidence on the first application of the wet-sheet—the same subsequent gradual depression for the the whole hour,—and the same reaction in the shallow-bath, and drying-sheet, but less marked than in the first operation. But there is another and truly remarkable similarity. If we look for the average number of beats of the pulse during the entire period of envelopement as in the last expe-

riment (viz., by adding the figures 62 twice to the numbers 72, 72, 69, 64 and 60, and dividing the sum by 7) we shall obtain 65.85 as the result. Now before the commencement of the process the pulse had been 100. This indicates a fall therefore of 34.15 per minute, for 100—65.85=34.15. In the preceding operation the corresponding fall was 34.86, the difference being merely a fraction.

As regards the respiration too, there is a general correspondence between the first and second operation, but less perfect.

The average number of respirations per minute for the whole hour is to be acquired in the same way as before, employing the figures 18.75 twice for the inserted amounts. It will be found to be 23.71, being a decrease from the original number by 00.29. In this case therefore, while the pulse sunk 34.15 beats in the minute, the respiration instead of falling in a corresponding ratio remained as nearly as possible stationary.

If the respiratory process had fallen in a corresponding ratio to the circulatory one, its average frequency during the packing would be about 15.80, for as 100 : 24 : : 65.85 : 15.80. Instead of which it was 23.71, that is 7.91 degrees more elevated than the latter, and indicating a fall from the original amount of only twenty-nine hundredths. And this may virtually be considered as an increase in the rapidity of the respiration. Quod erat demonstrandum. Vide Introductory Chapter, and the Analysis of the wet-sheet operations.

Operation III,

Of one hour and ten minutes' duration.

	Pulse, per minute.		Respiration, per minute.	
Before process......	100	......	24	
Immediately after.	80	......	32	
10 minutes after...	66	......	23.5	feels warm and
20 minutes after...	66	......	20	moist, and remains so
30 minutes after...	62	......	23	throughout, becom-
60 minutes after...	58	......	18	ing towards the end
70 minutes after...	58	......	18	quite hot.
In shallow-bath ...	96	......	26	
In drying-sheet ...	77	......	27	

Temperature of the wet-sheet 93° F.

Temperature of the water in the shallow bath raised from 48° F. to 49.33° F.

	st.	lb.	oz.
Weight prior to the operation	8	0	$10\frac{1}{4}$
Weight subsequent to the operation...	8	0	9
Loss...			$1\frac{1}{4}$

On adding together the figures 80, 66, 66, 62, 58 and 58, with the insertion of 60 twice to indicate the state of the pulse at the expiration of 40 and 50 minutes, and dividing the answer by 8, an average of 63.75 beats of the pulse per minute will be obtained. This shews a diminution of 36.25 beats, the original pulse having been 100, and 100—36.25=63.75.

If the figures placed under the respiration be treated in the same way, inserting the number 20.5 twice, as representing the middle quantity between 18 and 23, we shall get as the result 21.93.

Here also is seen a decline in speed from the original state of the respiration, the declension being in amount 2.07, for 24—2.07=21.93.

As the pulse was 100 before the commencement of the process, and the respiration 24, we may look upon those figures as representing the (in ordinary circumstances) just balance between the heart and lungs. But 24 : 100 : : 15.3 : 63.75. Wherefore the pulse having sunk to 63.75 the corresponding number of respirations would be 15.3. While however the former fell 36.25 in the minute, the latter fell only 2.07. And under the circumstances this may be considered vitually an *elevation* of the respiration, through the immense subsidence of the pulse.

Operation IV,

Of one hour and a half's duration.

	Pulse, per minute.		Respiration, per minute.	
Before process......	104	......	18	
Immediately after.	82	......	40	
10 minutes after...	72	......	23	feels warm.
20 minutes after...	70	......	24	feels quite hot, but
30 minutes after...	64	.....	22	moist. There is no
60 minutes after...	63	......	19	perspiration on the
90 minutes after...	60	......	19	forehead.
In shallow bath ...	74	......	26	
In drying-sheet ...	84	......	26	

Temperature of the wet-sheet 93° F.

Temperature of the water in the shallow-bath raised from 49.25° F. to 50.00° F.

	st.	lb.	oz.
Weight prior to the operation	8	0	$7\frac{1}{4}$
Weight subsequent to the operation......	8	0	6
Loss...			$1\frac{1}{4}$

The results of this operation as far as the pulse is concerned exhibit a general similarity to the three preceding ones, but in reference to the respiration more particularly resembles the first. For while there is an enormous fall in the pulsations of the artery, in those of the lungs there is

an actual increase. The average beats of the former, (found by adding up the numbers 82, 72, 70, 64, 63 and 60, and supplying the four extra ones 63.5, 63.5, 62 and 61, as before explained, and dividing the whole by the number of times, apparent and real, that the pulse was examined, viz. 10) will be ascertained to be 66.1 each minute of the hour and a half. Here is manifest a fall of 37.9 beats per minute, for 104—66.1=37.9.

The average amount of respirations per minute for the whole period of an hour and a half (discovered by adding the supplied numbers 21, 20, 19, 19, to those shewn in the above table, viz., 40, 23, 24, 22, 19, 19, and dividing the answer by 10) will be found to be 22.6, and consequently will betoken an elevation of 4.6, for 18+4.6=22.6.

Operation V.

Of one hour and forty minutes' duration.

	Pulse, per minute.	Respiration, per minute.	
Before process......	92	22	
Immediately after.	64	32	
10 minutes after...	64	24	feels quite comfortable & no longer cold.
20 minutes after...	71	24	feels quite warm.
30 minutes after...	64	22	
60 minutes after...	62.5	22	
1 h. and 40 m. after	53	22	
In shallow-bath ...	84	21	
In drying-sheet ...	84	29	

Temperature of the wet-sheet 90° F.

Temperature of the water in the shallow-bath raised from 53° F. to 54° F.

	st.	lb.	oz.
Weight prior to the operation	8	0	4½
Weight subsequent to the operation......	8	0	2¼
Loss...			2¼

In this operation there occurs a strange anomaly. There is an abrupt elevation of pulse which takes place at the elapse of 20 minutes, and curiously interrupts the ordinary gradual depression of its rapidity. After the pulse had sunk from 92 to 64, and remained at the latter point stationary for some time, it in a remarkable manner, and for some reason which the author cannot explain with certainty, rises to 71. It does not however continue to rise, but quickly subsides again, eventually to fall considerably lower than is usually the case.

It not unlikely that the individual packed made some little bodily effort, perhaps in the endeavour to liberate a cramped arm, in the exertion of coughing, or some such trivial muscular exertion. Most probably the abrupt elevation of pulse was attributable to some petty casualty of this description.

The average rapidity of the pulse during the hour and forty minutes is to be calculated by adding together the figures 64, 64, 71, 64, 62.5, and 53, with the superaddition of the numbers 63.25, 63.25, 60.11, 57.74, 55.37 to supply the omissions (as already explained), and dividing the whole by 11. It will be found to be 61.66, indicating a fall of 30.34 from the original state of the pulse before the bath, for 61.66+30.34=92.00.

In case it may be imagined that the employment of so many supposititious figures falsify the experiments or their inferences in any manner, the author begs to observe that their omission entirely would only slightly alter the results, and that he calls in their aid to impart to the operations as much mathematical precision as possible. In the example before us, were no supplementary figures employed, the average pulse (calculated simply by adding together the figures 64, 64, 71, 64, 62.5, and 53, and dividing the sum by 6), would be seen to be 63.08, exhibiting a difference only of 1.42, and not so truly correct as the first estimate, viz., 61.66. Of course the same remark applies to the calculations regarding the respiration.

The average number of respirations per minute for the whole time, investigated in the same way (viz., by adding to the figures 32, 24, and 24, for every subsequent ten minutes 22, that is 3 times, and dividing by 11), will be ascertained to be 23.27. The original numbers being before the process 22, there is here manifested a rise of 1.27.

Operation VI.

Of two hours and a half's duration.

	Pulse, per minute.		Respiration, per minute.	
Before process......	96	......	19	
Immediately after.	84	......	32	
10 minutes after ...	70	......	22	becoming warm and
20 minutes after ...	72	......	22	comfortable.
30 minutes after ...	72	......	21	
1 hour after	64	......	21	
2 hours after	64	......	24	Forehead still dry.
2 hours and 30 m.	64	......	27	Nowhere sweating.
In shallow-bath ...	76	......	24	
In drying sheet ...	76	......	25	

Temperature of the wet-sheet 95° F.

Temperature of the water in the shallow-bath raised from 60.75° F. to 61.75° F.

	st.	lb.	oz.
Weight prior to the operation	8	1	$7\frac{3}{4}$
Weight subsequent to the operation ...	8	1	$5\frac{1}{4}$
Loss...			$2\frac{1}{2}$

In this operation the subsidiary figures will be found to be 69.34, 66.67, for the interval between 30 minutes and 1 hour, 64, four times repeated for the interval between 1 and 2 hours, and the same number, once repeated, for the interval between two hours, and 2 hours and a half. By adding these nine numbers to those in the above column that stand between 96 and 76, and dividing the result by 16,

the average rapidity of the pulse during the whole process will be found to be 67.12. These subsidiary figures may make the calculations a little complicated, but cannot be discarded, since they impart great accuracy to the experiments. In the present instance without their employment the results would be materially altered. The pulse would be estimated to beat 70 times in the minute instead of 67.12. The latter number indicates a fall from the original state of the pulse of 28.88 for 96—28.88=67.12.

The average quickness of the respiration is to be ascertained by employing the supplementary figures 21, 21, 21.5, 22, 22.5, 23, 23.5, 25, and 26, and adding to these numbers 32, 22, 22, 21, 21, 24, 27, as they occur in the above column, and dividing the whole by 16. The representative number will be 23.4, expressing an elevation from the original rate of speed of 4.4 for 19+4.4=23.4.

SECOND SERIES OF OPERATIONS, PERFORMED ON A PHLEGMATIC TEMPERAMENT.

OPERATION VII.

Of four hours' duration.

	Pulse, per minute.		Respiration, per minute.
Before process......	72	......	17
Immediately after.	52	......	18
10 minutes after...	54	......	25 getting slowly warm.
20 minutes after ...	52	......	22
30 minutes after ...	48	......	18 moderately warm,
1 hour after	44	......	18 never hot.
2 hours after......	42	......	18.5
3 hours after......	42	......	18
4 hours after......	46	......	26
In shallow-bath ...	72	......	26
In drying-sheet ...	72	......	24

Temperature of the wet sheet 95° F.

Weight prior to the operation	10	7	10
Weight subsequent to the operation	10	7	$6\frac{3}{4}$
Loss...			$3\frac{1}{4}$

As before mentioned, it will be perceived from the weight of the person who underwent this operation that it was a different individual. The first one was of a sanguine, excitable temperament, the disposition of the latter decidedly phlegmatic. It is important that the reader should retain this distinction in his recollection.

It may be as well here to caution the reader against so much as dreaming of continuing the action of the wet sheet for so long a period as described in these examples. In some cases, and without constant attention, it might be attended with considerable risk. The chief object even in the instance before us of prolonging the operations to so many hours was to contrast their effects with those of the sweating blankets, and to prove that they are *not*, as is generally supposed, of a diaphoretic character, however long they may be endured.

The average speed of the pulse during the four hours may be satisfactorily obtained by adding together and dividing by 25 the following figures, 52, 54, 52, 48, 46.66, 45.33 (the latter two numbers for the periods of 40 and 50 minutes after the commencement) 44, 43.65, 43.32, 42.99, 42.66, 42.33, (the latter five numbers respectively for each ten minutes between the one and two hours) 42, 42, 42, 42, 42, 42, (the latter five numbers respectively for each ten minutes between the two and three hours) 42, 42.67, 43.34, 44.01, 44.68, 45.35, (the latter five between the three and four hours) and 46. The result of this sum is 44.68. Here therefore is shewn a decrease of 27.32 beats in the minute, for 72—27.32=44.68.

Once more the author feels it incumbent upon him to apologise to the reader for this horrible accumulation of

dry figures. It is to the *kindly disposed* reader alone that this apology is made. But there are other readers of a severer class, who listen incredulous to a man's story, till fact and proof are produced. And it is to establish conviction in the minds of this critical sort that the author has recourse to so many figures. He hopes that the former benevolent and non-sceptical reader will at once pass over them, when they stand in his way, and prove uninteresting.

The respiration on the other hand will be found to present an increased ratio of speed by the application of the wet-sheet, for on adding together the figures 18, 25, 22, 18, 18, 18, (the latter two numbers answering to the periods of forty and fifty minutes) 18, 18.08, 18.16, 18.24, 18.32, 18.40, (the latter five answering respectively to each ten minutes between one and two hours) 18.50, 18.40, 18.32, 18.24, 18.16, 18.08, (the latter five being the five previously mentioned numbers reversed, and answering to the interval of two and three hours) 18, 19.33, 20.66, 21.99, 23.32, 24.65, (the latter five corresponding to the interval between the three and four hours) and 26, and then dividing the whole by 25, the product will be 19.67, and the index of the average rapidity of the respiratory movements during the whole time of lying in the sheet. Thus there will be discovered a rise of 2.67 in the minute, since $17+2.67=19.67$.

In reference therefore to the relation between the breathing and the pulse, that is, between the undulatory movements of the chest and the pulsations of the arterial system, the same principle that was so constant in the first six operations, is still preserved, (although the individual treated is different, and of a totally different constitution,) that is to say, the depressing effect on the pulse, and the elevating effect on the respiration.

Operation VIII,

Of four hours' duration,

	Pulse, per minute.		Respiration, per minute.	
Before the process.	72	......	20	
Immediately after..	54	......	20	after the first few minutes he describes himself as very comfortable, but neither warm nor cold, during the whole process.
10 minutes after...	52	......	24	
20 minutes after...	47	......	25	
30 minutes after...	45	......	22	
1 hour after.........	42	....	31	
2 hours after	42	......	22	
3 hours after	43	......	26	
4 hours after........	44	......	26	
In shallow bath....	60	......	26	
In drying sheet.....	60	......	26	

Temperature of the wet-sheet 93° F.

	st.	lb.	oz.
Weight prior to the operation...........	10	6	$8\frac{1}{4}$
Weight subsequent to the process	10	6	$6\frac{1}{2}$
Loss......			$1\frac{3}{4}$

The average rate of the pulse per minute during the four hours is calculated by adding together and dividing by 25 the following figures, 54, 52, 47, 45, 44, 43, (the latter two subsidiary as before explained in the preceding operation) 42, 42, 42, 42, 42, 42, (the latter five numbers subsidiary) 42, 42.17, 42.34, 42.51, 42.68, 42.85, (the latter five subsidiary) 43, 43.17, 43.34, 43.51, 43.68, 43.85, (the latter five subsidiary) and 44. The result of this calculation will be 43.84, indicating a fall from the original state of the pulse before the process of 28.16, for 72—28.16= 43.84.

The average rapidity of the respiration is calculated by adding together and dividing by 25 the following figures, 20, 24, 25, 22, 25, 28, (the latter two numbers being subsidiary) 31, 29.5, 28, 26.5, 25, 23.5, (the latter five subsi-

diary) 22, 22.67, 23.34, 24.01, 24.68, 25.35, (the latter five subsidiary) 26, 26, 26, 26, 26, 26, (the latter five subsidiary) 26. The result will be seen to be 25.26, exhibiting a rise of no less than 5.26, for $20 + 5.26 = 25.26$, and that too while the pulse sinks 28 beats!

Operation IX,

Of four hours' duration.

	Pulse, per minnte.		Respiration, per minute.	
Before the process.	60	......	24	
Immediately after.	56	......	25	experiences what he calls a comfortable, soothing, and pleasing effect, but is not decidedly warm.
10 minutes after...	48	......	20	
20 minutes after...	46	......	25	
30 minutes after...	44	......	21	
1 hour after.........	42	......	19	
2 hours after........	40	......	20	
3 hours after	40	......	19.5	
4 hours after........	44	......	20	
In shallow bath....	56	......	28	
In drying sheet....	72	......	28	

Temperature of the wet-sheet 92° F.

Temperature of the water in the shallow bath raised from 47.5° F. to 49° F.

	st.	lb.	oz.
Weight prior to the process	10	6	$0\frac{1}{2}$
Weight subsequent to the process......	10	6	0
Loss......			$\frac{1}{2}$

By adding together and dividing by 25 the following figures 56, 48, 46, 44, 43, 43 (the last two subsidiary) 42, 41, 41, 41, 41, 41 (the last five subsidiary) 40, 40, 40, 40, 40, 40 (the last five subsidiary) 40, 40.66, 41.32, 41.98, 42.64, 43.30 (the last five subsidiary) and 44, the numbers 42.43 will be obtained. These denote the average rate of speed with which the pulse moves per minute during the process, and indicate a fall from the original rapidity before

the commencement of the operation of 17.57 beats, for 60—17.57=42.43. This is the slightest diminution that has yet been observed, and for a good reason, as will be afterwards explained. (Vide the analysis of the wet-sheet operations.)

With regard to the respiration also there is the same singularity attached to the operation now under examination. It will be found on instituting the usual investigation that the breathing subsides in rapidity on the average during the whole process nearly four degrees in the minute. For on adding together and dividing by 25 the following numbers, 25, 20, 25, 21, 20, 20, (the two last subsidiary) 19, 19.17, 19.34. 19.51, 19.68, 19.85, (the last five subsidiary) 20, 19.90, 19.82, 19.74, 19.66, 19.58, (the last five subsidiary) 19.50, 19.58, 19.66, 19.74, 19.82, 19.90, (the last five subsidiary) 20, the dividend will be 20.17. This shews a decrease in the respiratory movements of 3.83 per minute, for 24—3.83=20.17.

Analysis of the Wet-Sheet Operations.

The commencement of the first analysis in the work will afford a fit opportunity for the author's requesting particularly the general reader's attention to the matter contained in them all. They will be a summary of the results of all the preceding experiments, taking also a comparative view and review of the whole. While the accuracy of the details of the operations is intended to captivate the attention of the purely scientific and critical eye, the final analytical review and to a certain extent recapitulation is more adapted to the perusal of everybody else. Let us now at once commence with the analysis of the wet-sheet operations.

In the first place let the author draw the attention of the reader to the fact of the two persons submitted to the wet-sheet packings being well marked specimens of antagonistic temperaments. The natural disposition of the first

one was excitable, nervous, sanguine, both mentally and physically. That of the second was just the very contrary, essentially phlegmatic as a Dutchman. All temperaments whatsosver may be and are resolvable into one or other of these two, or into compounds of both containing various proportions of each. In truth there are but two of what may be called pure temperaments, and they are those just mentioned. All others, as bilious, leuco-phlegmatic, &c. &c. are but modified forms of the same. Averages, therefore, deduced from these two opposing and extreme forms of constitutional temperament will probably serve in as correct a manner as possible to illustrate the effects of hydropathic measures upon the general mass of individuals. For of course the *mean* of two *extremes* must be a *moderate* ratio. So here a medium drawn from the effects of certain measures on a very excitable and on a very phlegmatic disposition must be the same as the effects of the same measures upon persons neither so excitable nor so phlegmatic.

In the first six operations the pulse at the commencement of the process will be found to be, beginning with the first, as follows, 104, 100, 100, 104, 92, 96. This will yield an average of 99.33. The great elevation above the normal rapidity here shewn is one circumstance, whence is deduced the peculiar temperament of this individual. In the same operations, the pulse, immediately after the body was enveloped in the sheet, was respectively 84, 72, 80, 82, 64, 84. The medium number of these six is 77.66. And 99.33—77.66=21.67. Thus then in the time that it takes for a man to lie down, and have the two ends of a sheet lapped over his body, in one minute, sometimes in less than one minute, is the pulse fallen nearly twenty-two beats in the minute! *In less than one minute twenty-two beats!* Was not this, before the discovery of the wet-sheet, inconceivable?

In the seventh, eighth, and ninth operations, namely, those performed by the individual of the phlegmatic dia-

thesis, the numbers indicating the rate of speed of his pulse before the processes were these, 72, 72, 60; observe the forcible contrast here exhibited between the present and the preceding example, and occasioned by the difference in temperament. The medium amount of these then is 68, more than thirty degrees lower than the foregoing, which was 99.33. The numbers denoting the pulse immediately following the wet-sheet wrapping were respectively 52, 54, 56. The average here is of course the middle figure 54. And 68—54=14.

This subsidence of fourteen pulsations in the minute is every whit as remarkable as the previous fall of twenty-two. For what has been before stated about the difference of their temperaments must now be taken into consideration. A man of cold, phlegmatic constitution is always less susceptible to external influences than one of the contrary disposition. Therefore it would be imagined *a priori*, that the wet-sheet would produce less marked arterial depression in the latter three cases than in the six former. Besides which the pulses being so most dissimilar in rapidity at the commencement of the process, the average being in the one case 99, and in the other 68, the former could *afford*, so to speak, to lose much more speed than the latter.

If now we draw an average from the two cases unitedly by adding 99.33 to 68, and dividing the quotient by two, we shall obtain as a result 83.66. And by doing the same thing with regard to the pulse immediately after the envelopement we shall get the figures 65.83. And 83.66—65.83=17.83. This, therefore, a result gained by the comparison of two perfectly opposite natures, may be fairly stated to be the average amount of diminution of the pulse by the first application of the wet-sheet.

The average rapidity of the pulse for the whole duration of the process was in the first case 69.14, in the second 65.85, in the third 63.75, in the fourth 66.10, in the fifth

61.66, in the sixth 67.12, in the seventh 44.68, in the eighth 43.84, in the ninth 42.43. The constancy and consistency of these results are perfectly astonishing. The resemblance lies, as of course it should, among the first six between each other, and among the three last between each other. Combining the two divisions and estimating a general average from the whole number, we shall find such average to be 58.28. This shews a farther reduction below that induced immediately by the application of the cold sheet, of 7.55, for 65.83—7.55=58.28.

From these statistics it may be very properly inferred that as a general rule the pulse usually falls about seventeen beats in the minute on the first application of the wet-sheet, and subsides during the process seven or eight degrees more —provided the pulse before the operation be in the state in which it ought to be after moderate exercise, to wit, numbering about eighty-two or three—moreover, that when the pulse preceding the process is much more rapid than this, a much greater depression occurs, and when on the other hand it is less rapid than this before the process, the diminution is less marked.

Hence it appears of what extreme efficacy this operation may be in the treatment of febrile diseases. When a person labours under the following symptoms, namely, an accelerated pulse, a hot and dry skin, a furred tongue, loss of appetite, troublesome thirst, &c. &c., he is said to be the subject of fever or feverishness. This febrile excitement may be in the shape of a specific fever, as typhous or common continued fever, ague in its hot stage, small-pox, or measles, or it may be merely the general disturbance of the system associated with some local inflammation, as pleurisy, inflammation of the bowels, &c. And this state of the system, however modified by casual circumstances, as contagion, inflammation, or anything else, is commonly recognised as fever or a febrile paroxysm; but in truth it is only one stage of the complaint. It is the

hot stage, but it is preceded by a cold one, and followed by a sweating one.

The cold stage is characterized by a pallor and shrinking of the skin, and a feeling of chilliness. The sweating period bedews the tense and dry skin with moisture, reduces its heightened temperature, and restores the hitherto exalted pulse to its natural standard. These then are the stages of fever of *all* kinds, whether hectic, exanthematous, typhous, inflammatory, or any other. At the onset of the malady the blood is driven from the skin to the internal organs, the heart, liver, lungs, and large vessels, thus clearly accounting for the symptoms developed at the first period, namely, the feeling of coldness, the sensation of a stream of water trickling down the spine, the bristling of the hair, the knocking of the knees, and chattering of the teeth, and the general pallor and contraction of the whole surface. After a time the struggling heart and large vessels emanating from it by gigantic efforts try to relieve themselves of their superabundant contents, and with success. They manage to pump the blood, with which they have been during the cold fit surcharged, back into the superficial and cutaneous capillaries. And now the reaction occurs. The blood urged onward by the full force of the central circulating powers, rushes with violence into the tissues of the skin, and coursing tumultuously through their minute vascular channels over the whole surface of the body, creates the greatest excitement. Chilliness and shivering give place to flushes of heat, which grow more and more intense, and more prolonged. The cold, contracted skin inflames and burns. The arteries leap and throb. The tongue becomes dry and the throat parched, and the second or hot stage is fairly established. After this period has endured a certain time, the turgid vessels of the skin seek and obtain relief by the opening of their natural locks, the perspiring apparatus. These gates unclose, and a copious discharge of sweat is followed by instant

relief. The hot and thirsty tongue is cooled and moistened. The fiery flush of the skin is quenched. The noisy, and painful beating of the arteries is stilled. The pulse keeps more moderate time, and the whole system is soothed and quieted.

This is the natural termination of an attack or paroxysm of fever. The whole paroxysm may last but a few hours, as is the case in quotidian ague, or it may last several weeks, as frequently happens with common contagious fever. But in whatever garb the disease may be clothed, it always follows this course. This succession of symptoms constitutes the essence and sine qua non of fever.

The next matter to be enquired into is, as to the objects to be aimed at in the artificial treatment of the disease. Now in attempting to combat a disorder by the employment of any artificial remedy, we should always closely inspect nature, to see what means she brings to bear upon the complaint when left to her own management. In the present instance, viz. that of fever, we see that she abates the inflammatory tumult by cooling the skin, this being effected by perspiration. But how does the perspiration cool the skin? By evaporation from its surface, a large quantity of specific or sensible heat being by that process rendered latent or insensible. *So that nature herself gives the fevered patients a cold bath, producing the water from her own engorged capillaries.*

Medical practice following correctly the dictates of nature prescribes various simple sudorific medicines to effect this desirable end. To generate perspiration, in other words *to supply a cold bath,* she has recourse to a little antimony, a little ipecacuanha, a little acetate of ammonia, and so on. Sometimes these mild remedies produce a slight effect, more frequently none whatever. The theory and principal of action, and intention too are excellent enough, but how insufficient the practice all the world knows. Indeed so futile are all medicines in simple

fever, and when effective so harmful their effect, that it is pretty generally considered by medical men that the less they interfere with a patient suffering from fever, the more likely is he to weather the point of danger. Now see what hydropathy can do.

She also like her neighbour physic watches the instructions of nature with a jealous eye. She too like her co-temporary observes the method to which nature has recourse to cool the patient. She is delighted to see the *cold bath,* in which the patient bathes with such happy and refreshing results. When therefore such a malady is presented to her scrutiny, and its cure entrusted to her treatment, she strives at once to imitate her guide; but how? Simply by the employment of an *artificial* cold bath. And the best form of cold bath that can be employed in these febrile affections is the wet-sheet packing. On account of its excellent effect in soothing pain, allaying irritation, and exercising a general tranquilizing power it is more adapted for this object than any other kind of bath.

But this remedy should always be used in the middle or hot stage, if possible. It must never be employed in the cold one, and rarely, if ever, in the sweating one, certainly *never* if the perspiration be at all profuse, or if it has been going on for some time. The reason of its prohibition in the first stage of fever must be obvious to every one; and perspiration being itself a powerful cooling agent of course, when fully established, requires no aid from without.

If what is called common continued fever, or typhus, be submitted to a close scrutiny, it will be be found generally the subject of distinct remissions and exacerbations. It is in fact nearly always increased in severity towards night, and alleviated in the morning. A more distressing thrist, greater restlessness, and an increased amount of general febrile excitement denote with sufficient clearness the exacerbation, while an abatement of these symptoms point

out the remission. When an obvious paroxysm such as this can be discovered, it should always be chosen as the fit time for the administration of the wet-sheet packing. But whenever there is a sense of chilliness present, or the skin is not hot and dry, or there is any considerable perspiration, then the cold application must be postponed to a more fitting opportunity.

The employment of the wet-packing is followed by a beneficial and grateful perspiration, which is quickly succeeded in turn by calm and refreshing slumber.

It is universally admitted by the first authorities, that the best form for administering cold water treatment in fevers is the wet-sheet packing. But the author is going to introduce some cases (to shew the value of the wet-sheet in these diseases) that were not treated by the wet sheet. This may appear inconsistent, but it will answer the end he has in view. The cases were treated with cold affusion, but it was before the wet-sheet was known. However successful the results therefore, it is to be fairly presumed they would have been at least as successful, if not more so, had the more efficient antiphlogistic remedy the wet-sheet been substituted for the cold affusion, for the reasons above mentioned. Why the author does in preference choose to illustrate his observations by cases *not* treated with the wet-sheet is this. He wishes for obvious reasons to quote from a non-hydropathic author, especially as he has an opportunity of doing so from so eminent a physician as Dr. James Currie, of Liverpool; from that gentleman's Medical Reports the following narrative is extracted.

"In a dark, narrow, and unventilated cell off the guard-room, it was usual to confine such men as were sent to the guard for misbehaviour, and about the 20th of May, 1792, several men had been shut up in this place on account of drunkenness, and suffered to remain there twenty-four hours, under the debility that succeeds intoxication. The typhous or gaol fever made its appearance in two of these

men about the 1st of June, and spread with great rapidity. Ten of the soldiers labouring under the complaint were received into the Liverpool Infirmary, and the wards alotted to fever could admit no more. The contagion continuing its progress, a temporary hospital was fitted up at the fort, and I was requested to give my assistance there to a surgeon of the regiment, by Captains Brereton and Torriano.

In two low rooms, each about fifteen feet square, were fourteen patients labouring under fever. They were in different stages of its progress: one was in the fourteenth day of the disease, two were in the twelfth, and the rest from the ninth to the fourth inclusive. The symptoms of the fever were very uniform. In every case there was more or less cough, with mucous expectoration: in all those who had sustained the disease eight days and upwards there were petechiæ on the skin: in several there were occasional bleedings from the nostrils, and streaks of blood in the expectoration. The debility was considerable from the first, and it had been increased in several cases by the use of venæsection, before the nature of the epidemic was understood. The pulse varied from 130 strokes in the minute to 100: the heat rose in one case to 106° F., but was in general from 101° to 103°; and towards the latter stages of the disease it was scarcely above the temperature of health. Great pain in the head with stupor pervaded the whole, and in several instances there occurred a considerable degree of low delirium.

Our first care was to ventilate and clean the rooms, which were in a high degree foul and pestilential. Our second was to wash and clean the patients themselves. This was done by pouring sea water, in the manner already described, over the naked bodies of those whose strength was not greatly reduced, and whose heat was steadily above the temperature of health. In those advanced in the fever, whose debility was of course great, we did not venture on

this treatment, but contented ourselves with sponging the whole surface of the body with tepid vinegar, a practice that in every stage of fever is salutary and refreshing.

Our next care was to stop the progress of the infection. With this view the guard-house was at first attempted to be purified by washing and ventilation, the greater part of its furniture having been burnt or thrown into the sea. All our precautions and exertions however were found to be ineffectual. The weather was at this time wet and extremely cold for the season; the men on guard could not be prevailed upon to remain in the open air; and from passing the night in the infected guard room, several of the privates of the successive reliefs caught the infection, and fell ill on the 10th, 11th, and 12th of the month. In several of them the fever ran through its course; and in others it was immediately arrested by the affusion of sea-water as already described. No means having been found effectual for the purification of the guard-room, it was shut up and a temporary shed erected in its stead. Still the contagion proceeded: in the morning of the 13th three more having been added to the list of the infected. On that day therefore the whole of the regiment was drawn up at my request, and the men examined in their ranks. Seventeen were found with symptoms of fever upon them.—It was not difficult to distinguish them as they stood by their fellows. Their countenances were languid, their whole appearance dejected, and the tunica adnata of their eyes had a dull red suffusion. These men were carefully separated from the rest of the corps, and immediately subjected to the cold affusion, always repeated once, and sometimes twice a day.—*In fifteen of the number the contagion was extinguished;* but two went through the regular disease. On the same day the commanding officer, at my desire, issued an order for the whole of the remaining part of the regiment to bathe in the sea; and for some time they were regularly mustered and marched down at high water to plunge into the tide.

These means were successful in arresting the epidemic; after the 13th of June no person was attacked by it. It extended to fifty-eight persons in all, of which thirty-two went through the regular course of the fever, and in twenty-six the disease seemed to be cut short by the cold affusion. Of the thirty-two already mentioned two died. Both of these were men whose constitutions were weakened by the climate of the West Indies; both of them had been bled in the early stages of the fever; and one being in the twelfth, the other in the fourteenth day of the disease, when I first visited them, neither of them was subjected to the cold affusion."

Here then were fifty-eight cases of which fifty-six were treated hydropathically and all recovered, and two treated by the regular practice and both died. Of the fifty-six cured thirty were conducted safely through the disease, but in twenty-six the fever was not permitted even to run its course, but was at once attacked and annihilated by the cold affusion. But according to the recent hydropathic discoveries, eminently successful as this treatment was, the wet-sheet would have been the more fit remedial application. The latter indeed is now the nearly universal form in which fever is treated by cold water.

The author will now take the liberty of citing two or three more examples of the curative effects of cold water (and therefore in particular of the wet-sheet) in fevers. They are again taken from the work of celebrated hydropathic physicians. This work is entitled "Ψυχρολουσια or the History of cold bathing," by Drs. Sir John Floyer and Edward Baynard. The quotations are as under.

"In fevers I have known a great many in my time, who by the over-care of their health-wrights were made delirious, and in their phrensy have leaped into a pond, or any other cold water, and not one, as I ever heard of, ever got any harm, but was thereby presently cured. And Dr.

Willis, I remember, instances a case or two, wherein they have recovered by immerging into cold water, either by accident or distraction. And lately I saw at Mr. Charles Frubshaw's, at Salisbury court, a servant-maid, who, not long before, being delirious in a most intense fever, got loose and leaped into the river Thames, but, being soon taken up by a boat, was brought home in her wet-clothes, who no sooner being stript and dry clothes put on, but she went about her business, and *was well as ever she was in her life.* I had often heard this story in the neighbourhood, but being curious in the thing, I sent for the maid, and had this relation from her own mouth.

"A learned and ingenious gentlemen, a Doctor of Laws, now living, told me that, being light-headed in a fever, and most intensely hot and thirsty, got from his nurse and rushed into a horse-pond in the yard, and there stayed above half an hour; it brought him presently to his senses, and allayed both his heat and thirst; after which, when in bed, he fell into a sound sleep, and when he awaked (in a great sweat), he found he was well.

"I myself, about the middle of July anno 1702, became very feverish (I suppose from drinking of milk upon eating melon, when I had been fast walking and very hot), my tongue was rough and white, my mouth clammy, and an ill taste, my urine of a bright amber colour, but no separation by standing, nor blue stain on the glass; slept very disturbedly, and had a quick, high, towering pulse; had strange flashes in my blood, like wild fire, which I could perceive in my face, neck, breast, and extreme parts, (and God forgive me, not so well prepared for a journey to the other world, as I ought to have been,) and found the fever to kindle upon me, and dreading the consequence of being delirious, knowing that the executioners would crowd in upon me and cere me alive in a sheet of blisters, &c. These considerations were terrible to think on, and that something was to be done quickly whilst I was my

senses, and durst not bleed in a pale urine ; I took half an ounce of cream of tartar in the bath water, which gave me three or four stools, *which made me much worse.* I sweat extremely spontaneously before I took the cream of tartar, but had no relief by it at all. I called my servant to get ready my swimming shoes, (for I have a tender foot, and cannot tread upon the stones), so down to the river went I at nine o'clock at night, and in leaped over head and ears, as they say, and swam up and down for some time under half an hour ; so home I came, and to bed I went ; I found myself in a state of neutrality, neither better nor worse. I at the cold water again the next day, and swam longer than the first time, and came home *as well as ever I was in my life,* and eat venison pasty, and drank a bottle of claret."

All fever or feverish excitement is accompanied and indeed characterized by congestion of the skin, which may endure for a more or less lengthy period. In the intermitting form, which is called ague, this congestion of the skin occurs every day or every second or third day, according to the constitution of the fever, but always subsides leaving no traces of its presence behind. Typhus, or common continued fever sometimes leaves no mark on the surface, but sometimes again it gives rise to certain, little, definite, inflammatory congestions in the shape of papulæ or pimples, which are technically called "maculæ." When these shew themselves, the disease takes the name of maculated or spotted fever. Besides this affection there are other varieties of fever which constantly imprint their character on the skin by distinct eruptions. These may be termed the "*accidental remains*" of the cutaneous congestion that is natural to all fevers. This eruption may assume different shapes, and varying degrees of intensity in the inflammatory process. Thus Scarlet-fever and measles are distinguished by a mere efflorescence or reddening of the surface both of the skin and certain portions of

mucous membrane. In chicken-pock the cutaneous inflammation is developed in the form of vesicular elevations, the external portion of the skin, or cuticle being raised by the secretion beneath of a limpid, watery fluid. Small-pox is marked by the appearance of pimples, which subsequently suppurate and discharge a quantity of thick matter.

But although the temperature of the skin is invariably exalted, and although this cutaneous congestion always presents itself, still it is not confined exclusively to the skin. For example, in scarlet-fever in addition to the external eruption there is an efflorescence, pathognomonic of the disease, in the mucous membrane of the throat, or as it may be called, the internal skin. So also in measles equally unvarying with the visible, external redness there exists an internal congestion of the mucous membrane of the air passages, likewise characteristic of the disorder. This gives origin to the sneezing, suffusion of the eyes, bronchial irritation, such certain concomitants of the complaint. The author remembers at this moment one affection of the same class of diseases as those two just mentioned, where the peculiar symptoms, that stamp its character, depend *entirely* upon the congestion of the internal skin, or mucous membrane. Hooping-cough is commonly supposed to originate in the enlargement of certain glands in the neck, caused by the absorption into the blood of an animal poison, and the glandular irritation produced thereby. It is said that these abnormal growths press upon and morbidly excite the nerve upon whose influence the motion of certain of the muscles of respiration depend, and that this excitement causes spasmodic fits of coughing. It seems to the author however far more probable, from the general family resemblance between hooping-cough and the eruptive diseases above referred to, that it belongs to the same group, the nervous irritation and consequently the muscular spasm being produced by the developement of the specific eruption on the

mucous membrane of the respiratory tract, in brief on the *internal* skin, instead of on the *external.*

In all these eruptive diseases therefore the pathology being very similar to that of common ague, or typhus, and the symptoms, merely varying from accidental contingencies, the treatment one would argue theoretically, should be similar. And correctly too. For the treatment practically is the same both in medicine and hydropathy. The former almost always commences by the administration of a purgative, and then contents itself with the employment of mild diaphoretic remedies throughout the progress of the disease. The treatment pursued by the latter is the employment of the wet-sheet.

The treatment of the eruptive or exanthematous fevers, as measles, scarlet-fever, chicken-pock, &c., by the application of the wet-sheet is now so generally admitted to be not only safe but most efficacious, that the author abstains from relating any cases in proof of this assumption. Although he has prepared many for the purpose of laying before the reader, still in order that he may not increase too much the bulk of this volume, they shall not be inserted. He will content himself with merely laying down one most important practical rule in the treatment of all fever by the wet-sheet. It is this, *Never apply the sheet in fever except the pulse be more rapid than normal, and the skin more heated. Otherwise it will inevitably do more harm than good. And if the skin be chilly and the pulse very feeble, even though it may be fast, it might perhaps be fatal.* The following case is extracted from a newspaper published a few days ago. It is entitled

"*Death accelerated by hydropathic treatment.*—A coroner's inquest was held at the George Inn, Battle, Sussex, on Wednesday, before Mr. N. P. Kell, coroner, to inquire as to the death of J. Slatter, aged 36, son of one of the oldest and most respectable tradesmen in that town. From the evidence it appeared that several members of the

family had been suffering from severe attacks of typhous fever, and Alfred, the brother of the deceased, had followed the hydropathic system of treatment with deceased's assistance and with satisfactory results. On Alfred's recovery he had gone to London, and deceased on being taken ill summoned him to return to Battle to administer the same system of remedial measures—wet-sheets, hot blankets, sponging with vinegar, &c. This was done perfectly to the satisfaction both of the sufferer and his attendant, who, not daunted by so formidable a symptom as the passage from the bowels of masses of coagulated blood, which indeed they considered rather favourable than otherwise, deemed medical advice unnecessary, and till a late hour on Monday night the patient was not seen by any member of the profession. E. Holland, surgeon, Battle, deposed, that at the request of some of deceased's friends he went to see him the night previous to his death. He found him in the last stage of the disease. Restoratives were prescribed, but without effect. At half-past two on the morning of Tuesday deceased was by his own desire raised in the bed to take some tea, but the effort was too great for his strength, and he fell back upon the pillow and expired. His opinion was, that although in some cases the hydropathic system might be useful, it required great care as to its management, and that deceased died from congestion of the intestines, produced by exhaustion attendant upon the disease, and without doubt accelerated by the mode of treatment adopted. The jury returned a verdict to the above effect, adding that "the jurors censure the too indiscriminate use of the hydropathic treatment towards the deceased, and express their regret that medical advice and assistance were not sooner called in."

In this verdict there can be no question the jury were perfectly correct. And the author entertains little doubt that the above rule was lamentably infringed. In all pro-

bability the unfortunate victim of his own and fraternal folly was wrapped in the sheet repeatedly without reference to pulse, skin, perspiration or no perspiration, or anything else. *Whereas neither when the pulse is feeble, or slow, nor when the skin is cold or bathed in perspiration, nor when there is any sign whatever of great debility should the employment of the wet-sheet in fever be for a moment entertained.* It is essentially a remedy for fever in its hot stage.

Now it has been stated that the efficacy of the wet-sheet in the eruptive fevers is so well known that the author deemed it to be superfluous to bring forward any cases, although he had many at hand. It is not however so generally known, even to the hydropathic world, that inflammatory fever, that is the febrile excitement accompanying and dependent upon some local inflammation is equally amenable to this admirable remedy. Yet it is the fact. And to support this fact both theoretically and practically a few paragraphs will be devoted.

In the first place be it understood that the symptoms exhibited by the fever of inflammation, as of the lungs or bowels, are precisely the same as those developed by any specific fever, as typhus or small pox. There is the same accelerated pulse, the same burning skin, the same foul tongue, &c. &c. These of course are modified somewhat in different cases, but they are essentially identical. The only difference then between a case of inflammatory fever and an ordinary fever is that in the former case there is superadded some localized inflammation. But this defined spot of inflammation makes just all the difference in the medical treatment of the two cases. In fever without it, as has been before stated, the faculty generally are of opinion, that the less artificial aid administered the better. And they merely order a few mild sudorifics. Not so, however, with regard to inflammation. To fight against this they have an armament of great power—blood-letting, mercury, purgatives, and other antiphlogistic remedies.

Now what is the object aimed at by this array of powerful remedies? All of them have but one object, and that is to reduce the action of the heart — to lower the pulse. Whether blood be abstracted from the arm, calomel or blue pill be administered, purgation practised, or other small fry medicines of a febrifuge and diaphoretic character be swallowed, but one goal is held in view, namely, the reduction of the pulse. And why is this single purpose so strenuously sought after by all medical practitioners? Because it is believed that an abatement of all the other febrile symptoms will follow, or accompany it. Most well-grounded the belief, most indisputable the fact, most laudable the aim, but how wofully inadequate the means! That is to say in comparison with the hydropathic method. In the first six wet-sheet operations, that is in those where the frequency of the pulse more nearly resembled a state of feverish excitement than in the last three, the amount of reduction of the pulse by the packing for each operation may be seen in a tabular form as below :—

Operation.	Amount of reduction.
1.	34.86
2.	34.15
3.	36.25
4.	37.90
5.	30.34
6.	28.88

Estimating an average from these figures it will be found that the pulse fell in rapidity 33.73 beats in the minute. In these same six operations the average speed of the pulse before the commencement of the process was 99.33, so that during the period that the packing lasted the pulse absolutely diminished more than $\frac{1}{3}$ of its original number of beats! Can diaphoretics, or febrifuges, ipecacuanha, acetate of ammonia, sweet spirits of nitre effect this? Can purgation, even the most drastic, do it? Can calomel, blue pill, or Plummer's pill? Lastly, does even the most

all-powerful blood-letting possess the power of achieving results equal to this? The author does not think that any medical practitioner will for a moment deny that bleeding, mercury, purgatives, or any drug the pharmacopœa can produce, is capable at all events of reducing the pulse so speedily as the wet-sheet. For in the first six cases just quoted it has been shown there was an average reduction of the pulse of more than twenty-one beats in a minute, or less than a minute!

If it be granted that the object held in view in the treatment of acute inflammations, as pleurisy, inflammation of the bowels, &c. is to quiet the heart's action, and to evidence this by lowering the pulse, and that the wet-sheet possesses this power in a pre-eminent degree, surely the wet-sheet is pre-eminently adapted for the treatment of these acute inflammations. At all events the author believes it to be so, and such being his belief, he has put his theory to the test of practice.

The case that he is about to detail, was one well adapted for the purpose had in view. It was one of so serious a character that persons not steadfast in their faith would have been afraid to treat it by other than the ordinary routine practice. By the stethoscopic investigation he from time to time instituted into the state of the chest he ascertained clearly, that it was a case of very severe acute "bronchitis of the small tubes," or as it is sometimes called "suffocative bronchitis." In vulgar language it would be called "inflammation of the lungs."

On the 25th of November, 1849, I was summoned to the bedside of a patient labouring under a severe attack of acute inflammation of the lungs. She was a married woman, aged 39, of a rather corpulent habit. She had been troubled with a cough for three or four days, which was sufficiently severe to deprive her of all appetite, but not hitherto to confine her to her room. When I saw her her cough was very distressing, and her respiration accom-

plished with considerable difficulty. She complained of pain at the pit of the stomach, and displayed the usual symptoms of fever, viz. a furred tongue, great thirst, accelerated pulse, hot skin, &c. In a few days all these symptoms were aggravated. Her cough became violent and prolonged, and suffused the whole countenance with a dark red hue, making the veins stand out turgid with blood. What little expectoration was with immense difficulty and suffering achieved, was transparent, frothy, and very tenacious, indicative of the intense inflammation burning within. The breathing became noisy, and so short, that the patient was obliged to have her head and shoulders raised for fear of absolute suffocation. The pain in the chest assumed a lancinating, stabbing character, as though a knife were passing through her side. In one word the sword hung over her head suspended by a hair, and death might have claimed his own at any moment. When, lo! her symptoms were gradually ameliorated, and in the end she totally recovered. But how did she recover, when she commenced to improve? Not slowly, not gradually; on the contrary she galloped on to convalescence as rapidly as she had fallen ill. In *ten days* she was out of bed, and might have been sooner, but, as there was no necessity for it, I did not wish to hazard a relapse. In *fourteen days* her cough had vanished entirely. And what was her treatment? No bleeding! No leeches! No blisters! No cupping! No mercury! No purgatives! It would be useless describing it in detail, since no two cases can be treated exactly in the same way. Suffice it then merely to say that the cure was conducted hydropathically, and that the processes administered consisted of the wet-packing, the tepid shallow bath, and the copious imbibition of cold water.

When my patient was quite well, she told me that she had had three similar attacks, but *none so severe as the last.* For all of them she had been treated in the Infirmary of Manchester (I mention this to show that she had the best

professional advice that could be procured, and was treated in the most generally-approved manner). The first occurred five years ago. A *part* of her treatment was as follows:—she was *bled in* BOTH arms, not because the blood would not flow from the vein first wounded, but because one venæsection was not considered sufficient for the emergency of the case;—(but, remember, it was not so severe as the last, hydropathically treated)—she was *cupped twice* on the chest;—*fifteen leeches* were applied, and *one blister*. In spite of this powerful treatment she kept her bed *five weeks* (that is, rather more than three times as long as in the attack treated without the abstraction of blood). From the shock of this rude attack (of the disease or of the lancet, I don't know which,) she states that she has never perfectly recovered.

Eight or nine months afterwards, her enemy, inflammation of the lungs, assailed her again. Her case was again conducted under the same medical auspices. This time she was cupped once to the extent of *sixteen ounces* of blood; the teeth of *thirty leeches* were allowed to lacerate her skin at one sitting; mustard poultices were brought into play; and her back was burnt in three or four places by a *hot iron*, as a counter-irritant. Under this treatment, although the attack was not so severe as in the case hydropathically treated, she remained in bed *four weeks*, that is nearly three times as long. When she did get up, she was exceedingly ill, and for several weeks laboured under various distressing head symptoms, viz. pain, giddiness, confusion, &c. These were eventually removed; by what? a hydropathic application, the shower bath.

About a year elapsed between her second and third seizure. In the latter, treated in the same hospital by probably the same physicians, she lost *sixteen ounces of blood* by cupping, and as much more as would flow from the bites of from twenty to twenty-five leeches three times applied, that is from *sixty to seventy-five leeches*. This time

she was confined to her bed for five weeks, (that is *more than three times* as long as in the attack last treated). This time also her cough did not disappear till the expiration of *five months.*

The points of distinction between the results of the medical and of the hydropathic treatment of this patient are then principally and simply these:

On the three occasions of being medicinally treated she was confined to her bed during the respective periods of *five weeks, four weeks,* and *five weeks.* On the occasion of being hydropathically treated, *although the attack was more severe than any of the others,* she was confined to her bed *ten days.*

Secondly, the copious withdrawal of blood being in the three first instances followed by no good result, as we have seen by instituting a comparison between the four attacks, we should reason *a priori* that it must be attended with deleterious consequences. For this, the most vitally-endowed constituent of the body, from which every part of the human fabric is made, and upon whose good or bad properties health and disease depend, this living flesh, *chair coulante,* essence of life, cannot be allowed to escape with impunity. And our foredrawn conclusion is amply borne out by the facts of the case before us, namely by the difference in duration of the four periods of convalescence. After the first attack, to quote her own words, "she remained *very poorly for three or four months,* and has *never* since been so strong as she was before." After the second attack "she was *very ill for six or eight weeks,* and for three or four suffered a great deal of *head-ache, giddiness, and inability to distinguish different colors.*" These symptoms were removed by the shower bath. After the third attack *the cough itself was not removed before the completion of* FIVE MONTHS. After the last, and present accession the cough was gone entirely in a fortnight, and *fourteen days* after the disappearance of the cough, and

twenty-eight after the onset of the disease, she was quite well, and actively employed in domestic duties.

Concerning this case there still remains one thing to be said, and that by no means of an unimportant nature. Once more to use her own words, " After each of the three first attacks, constipation set in, and she had to use *aperient medicines* constantly, that is three or four times a week, for several months." The reader will anticipate the rest. After the present illness no constipation whatever has existed.

To sum up, therefore, the evidence upon this subject the author certainly thinks it has been made sufficiently clear on both theoretical and practical grounds, and by exemplification both on the healthy body and the diseased one, that the wet-sheet is peculiarly adapted for the treatment of fevers and inflammations.

Hence it follows also that this process is highly, if not most, useful in those kinds, stages, or conditions of *chronic* disorders accompanied by any amount, however slight, of febrile excitement.

Before proceeding farther, lest the reader should fall into an erroneous notion, it may be as well to mention that as a general rule the patient must not be detained in the wet-packing so long as those detailed in this chapter. Accordingly as the attack is severe must the wet-sheet wrapping be short in duration, and quickly repeated. And this must be done without the intervention of the shallow or any other bath. When this repetition is required there must be two bedsteads in the patient's room. While he is lying packed on one, the other must be prepared, so that he can turn out of one wet-sheet into another immediately. The frequency of this change must depend, as before mentioned, upon the ardency of the fever.

In the first six operations the number of movements of the chest in respiration per minute prior to the process would be represented by the following figures, beginning

with the first, 24, 24, 24, 18, 22, 19. These produce an average of 21.83. The number of respiratory movements immediately after the packing in the same operations, reckoning in the same manner, are thus arranged, 32, 36, 32, 40, 32, 32. The medium of these per operation would be 34. And thus is discovered an elevation of 12.17 in the minute on the immediate application of the wet-sheet. This *elevation* of 12.17 respirations took place at the same time that there occurred a *depression* of the pulse to the extent of 21.67 beats in the minute.

The average rate of speed for the whole period of the process in these six cases would be 23.34 respiratory movements per minute. This will denote an increase upon the original rapidity of the respiration before the commencement of the operations, which was 21.83, of 1.51, and while this increased rapidity of the breathing occurs, the pulse falls 33.73 beats. But while there is here manifested an exaltation of 1.51 above the first examined state of the respiratory process, there is a considerable diminution in speed in comparison with that immediately after the first envelopement in the cold sheet.

In the three last operations the average number of respirations per minute before the beginning of the packing was 20.33. Those immediately after being wrapt in the sheet amounted to just 21. So that there is here seen an elevation produced by the cold shock of only .67 instead of 12.17, which was the increase gained in the first six operations. This difference clearly depends upon the difference in the temperaments of the individuals in the two cases, that one when the great exaltation was produced being mobile, easily susceptible to external impressions, and the other one being phlegmatic, not easily excited. While in the respiration this *elevation* of .67 is taking place, the pulse has *fallen fourteen* beats.

The average rapidity of respiration for the whole process in the same three operations would be 21.70 per minute.

This indicates a rise above the original state of breathing before the operation, which was 20.33, of 1.37, and also an exaltation above the rapidity of respiration immediately after the envelopement, which was 21, of .70. In this latter respect then there is an essential difference between the first and second sets of experiments. The dissimilarity may be with justice referred to the same dissimilarity in temperament. During the time, that the respiratory movements have been *gaining* 1.37 in the minute, the pulse has *declined* 24.35 beats.

It appears therefore that however much the two series of operations may differ in detail, they agree to a marvel in the one great particular. Indeed these very little discrepancies strongly confirm the main argument sought to be proved. This particular and this argument is that mentioned in the introductory chapter, namely the effect hydropathic measures produce in elevating the respiratory process in proportion to that of the circulation, in other words in increasing the respirations in proportion to the number of beats of the pulse. The admirable physiological benefits arising from this cause in the maintenance of health, and in the removal of disease, have been to a certain extent dwelt upon in the introductory chapter. And they need not be recapitulated.

Perhaps the reader may call to mind that, when talking upon this subject in the first chapter, and shewing how chronic disease was amenable to the hydropathic treatment in a great measure, through this excellent principle, the author among other causes of chronic disease mentioned congestion. Yet the water-cure has somehow or other obtained the credit of *producing* this decreased condition, this congestion.

Patients have frequently enquired of the author, if in such or such a case, or by this or that process, or in Mr. so and so, there be no liability of "congestion." They tell him moreover that although their family medical

advisers granted that in some cases the hydropathic system might be of service, still in their case they were very much afraid of "congestion." Thus one person will be afraid of it producing congestion of the head, another of congestion of the chest, another of congestion of the liver, another of no particular congestion, but of general internal congestion. Now nothing can be more absurd than this bug-bear theoretically, and nothing more untrue practically. It is well known to every one at all cognizant with the theory and practice of hydropathy that its very essential and characteristic property is to determine blood to the *surface*, to draw it *from* the viscera, and *to* the skin. Is not this one specific effect of the wet-sheet, the sweating blankets, the sitz-bath? And is it not the general effect of all the ordinary cold tonic baths as the dripping-sheet, the shallow-bath or the candouche? and of even the douche itself? Nevertheless it must be admitted that the persons who, to their shame be it spoken, are totally unacquainted with the physiological effects of water applied externally to the body, it must be admitted that to such persons it would appear on a primâ facie view somewhat reasonable to suppose that the employment of cold applications should give rise to some local congestion in a system predisposed to such an affection. But this foundationless and empty reasoning is at once put to flight, or at all events, invalidated by every-day experience. To bring forward an example, the author has at the present moment under his care a gentleman, who will well illustrate all the circumstances of the case. He is about forty-five years of age and declares that he has been subject to fits of asthma for forty years. There can be no doubt from the clear manner in which he details his case, that his symptoms were once those of genuine spasmodic asthma, his early seizure being probably due to inheritance, or at all events to some peculiar constitutional tendency. Be that as it may, he does not now suffer from spasmodic asthma. His symptoms when he

first came to the author, were considerable permanent difficulty in breathing, the latter being always audible; a constant cough, liable to exacerbations and remissions; the expectoration of a thick, opaque, yellowish phlegm; frequent sharp pains at the margin of the ribs on both sides in front; and frequent severe pain at the most projecting part of the spine, requiring him, to obtain ease, to press the part firmly against the head of a sofa, or back of a chair; slight lividity of the eyelids, and lips; occasional fits of drowsiness and torpor; weak and watery eyes; very weak lower extremities; and a few other symptoms of dyspepsia and general debility, as flatulence, frequent diarrhœa, &c. On examining his chest physically it was discovered that the centre of the breast-bone and the corresponding part of the spine behind projected so much as to make the cavity of the thorax put on quite a globular appearance. And on instituting a stethoscopic investigation it was at once perceived that he laboured under considerable organic disease, recognised by the medical terms of "pulmonary emphysema" and "chronic bronchitis." The latter consisted in a chronic inflammation of the larger bronchial tubes of both lungs, this inflammation giving rise to the secretion of the thick yellow stuff, that was expectorated. And the emphysema consisted in the dilatation and rupture of a large quantity of air cells in both lungs equally. The dilatation and rupture, produced at some time or other by prolonged and severe fits of coughing, caused the existence of large cavities, which became extensive reservoirs for stagnating air. For at each inspiration air is capable of entering them, but at the expiratory movement which follows, is incapable of retreating. Hence they sometimes, as in the present instance, attain so monstrous a size by continual distension, that they materially disfigure the external appearance of the chest.

Such was the condition of this gentleman, when he had recourse to the author for advice about seven weeks ago.

He came contrary to the counsel of all his friends, and in direct contradiction to the opinion of his usual medical attendant. When he arrived, one of the first things he enquired was, whether there was any fear of internal congestion, for that his medical adviser had assured him that although the hydropathic applications might be available in some diseases with advantage, in him they would certainly cause such congestion as would entail considerable danger. He was of course immediately answered that it was perfectly true that in his case, where there was already congestion of the head and chest, any additional congestion might produce most deleterious consequences, but that it was equally true, that with judicious treatment no such addition was with any reason to be apprehended. Since that period he has had cold ablutions on the whole body with dripping towels ; he has also had the wet-sheet packing and the cold sitz bath, not only without the arrival of this dreaded apparition, but with such marked benefit, that nearly all the symptoms that were curable have been either cured, or ameliorated. The emphysema of course and its necessary consequences, the distortion of the chest, and difficulty of breathing, are incurable. But the dull pain in the back, and the sharp pains at the margins of the ribs are gone. The difficulty of breathing is less than it was. The fits of torpor and drowsiness are much less frequent. All dyspepsia has vanished. Nay more, his breathing is never better, if so well, which is equivalent to saying, his chest is never less if so little harrassed or congested with blood, as when lying in a wet-sheet packing or reposing in a sitz-bath. And from what has been said and proved to demonstration this fact can now be readily explained. The cold water applications heighten the rapidity of the respiration, but diminish the frequency of the pulse. This is tantamount to saying, more air, but less blood is admitted into the lungs than usual. Is not this the very way to ameliorate the breathing? For it has

been shewn, that there was already present in the pulmonary tissue a certain amount of congestion. Indeed this congestion is necessary to the existence of bronchitis. Now the more blood that enters the lungs and the less air that meets it, the more imperfectly is the purification of the blood therein effected, and as an inevitable consequence, the greater tendency there is for that fluid to stagnate in the vessels, in other words to *add* to the already existing congestion. And *vice versa* it necessarily follows, that the greater the quantity of air inhaled, and the less the tide of blood flowing into the lungs at the same time, the more perfectly is the aëration of that fluid discharged, and the more easily is already existing congestion overcome.

Here then is a case, where every predisposition existed for the developement of congestion both of the lungs and brain. Yet that condition, which in truth previously existed in both brain and lungs, was actually relieved by the cold water appliances, instead of being thereby exaggerated.

It may be safely laid down as a rule, that visceral congestion is decidedly *not* a thing to be apprehended as attendant upon the hydropathic system. It is a bug-bear, a false terror, nothing else.

As a further practical proof that this assertion is correct witness the case of "acute inflamation of the lungs" detailed a few pages preceding. The respiratory organs of this patient were congested to overflowing before the wet-sheet was used. If it had filled them still more, she must have inevitably and quickly died. But so far from this being the result, she rapidly and steadily recovered.

The author imagines now that many, if not all, persons would at first sight see great danger in that very property for which he has been so highly lauding the wet-sheet. He alludes to its depressing influence upon the arterial system. "What?" he can hear them cry, "Can our pulse be lowered thirty or forty beats in the minute with

impunity? Can it be brought down to forty and forty-two throbs per minute without risk? Are you sure it always recovers itself, and at the right moment?" &c. &c. To demolish all these scruples is the work of an instant. Refer to the experiments, and carefully observe the effects of the shallow-bath and drying-sheet. It will then be perceived that the unvarying effect of these two parts of the process throughout the whole of the operations is to accelerate both the pulse and respiration.

By an easy calculation applied to the nine wet-sheet operations it will be ascertained that the average rapidity of the pulse, when acted upon by the shallow-bath, was 72.66, and when under the influence of the drying-sheet 76.11. But it has been seen that the average speed of the pulse produced by the wet-sheet packing itself was 58.28. The shallow-bath therefore has raised it 14.38 beats in the minute, and the drying-sheet has still further elevated it to the extent of 3.45 beats. In operation No. 7 the pulse descended to forty-two. *Yet in the shallow-bath it was up again at seventy-two.* In operation No. 9 it went down even two degrees lower, and reached the unparalleled depression of 40. *Yet in the drying-sheet it was up again at* 72! Hence it is satisfactorily demonstrated, that there need be no anxiety occasioned from the fear that the pulse, however low it may have been reduced, will not be able to recover itself.

Moreover from these facts we draw two important deductions. The first is that as a general principle in chronic disease the wet-sheet packing must be peremptorily followed by a cold bath. The object of this sequence is two-fold, the one being that the cold water may act as a tonic to the skin, strengthening and constringing that membrane, which has been softened and relaxed by the aqueous vapor in the sheet (for when the sheet becomes warm, the patient is enveloped in a gentle cloud of vapor, the process becoming a mild vapor-bath)—the other object

being to insure an efficient and speedy restoration of the heart and vessels to their normal action. For of course it is not pretended to assert, that this enormous reduction of pulse, although of inexpressible value in the subdual of of disease, is anything but a highly artificial condition.

The second important practical deduction we derive from a consideration of the foregoing facts refers to the mode of treating severe acute diseases. Inasmuch as the cold bath and drying-sheet re-erect the fallen pulse, and the express object sought in the management of ardent fevers and inflammations is to tranquilize it, and maintain it tranquil, of course these two must in these circumstances be avoided. And such in point of fact, as before mentioned, experience teaches us is the best, most efficacious mode of treatment, and most speedy in its results. The plan to be adopted in such cases is to repeat the wet-sheet, according to the violence of the febrile excitement, every ten, fifteen, twenty, or thirty minutes, without the intervention of any other bath. For this purpose a double-bedded room must be employed, so that the invalid may pass from one wet sheet into another without delay, or interruption.

A few words now on the effect of the shallow-bath and drying-sheet upon the respiration. The average rapidity of the respiratory movements per minute while under the influence of the shallow-bath, and drawn from a comparison of the nine operations, is exactly 25. That caused by the drying-sheet is 26.77. And it has been already shewn that the average number of respirations during the whole process was in the first six operations 23.34, and in the last three 21.70. These two numbers added together and divided by 2 will yield a single average for the nine experiments of 22.52. Hence it follows that the shallow-bath quickens the respiration by 2.48 costal movements in the minute, for $25-2.48=22.52$, and that the drying-sheet further elevates it 1.77 for $25+1.77=26.77$. But before the commencement of the packing the nine experiments

produced an average of 21.08. So that it will be perceived, that throughout the whole process from the beginning to the end the rapidity of the respiratory movements is constantly rising. It is quite worth while to arrange this in a tabular form.

	Average respiration per minute.
Before the process	21.08
During the process	22.52
In the shallow-bath............	25.00
In the drying-sheet............	26.77

The exceedingly beneficial effect upon the system, resulting from this influence exerted upon the respiration cannot be too frequently or too forcibly impressed upon the reader. The author would urge the latter, now that he has arrived thus far, to retrace his steps, and reperuse the introductory chapter. As by first reading that chapter he has been able more to appreciate the value of the facts proved in this, so having had now demonstrated to him as incontrovertible fact what before was mere assertion, he will return to a perusal of the illustrations of the subject there displayed with infinitely more relish and satisfaction. He will once again see explained how at each inspiration a definite amount of atmospheric air is taken into the lungs, and that each contraction of the heart pumps into the same organs a definite amount of blood; how in a state of health one respiratory movement corresponds to so many contractions of the heart, and while this fixed correspondence or harmonious relation between the aforesaid viscera is maintained, the aëration or purification of the blood in the pulmonary tissue is accomplished in perfection, because there is just sufficient air and just sufficient blood admitted to be capable of employing the services of each other; how that a disturbance of this equilibrium is an extremely frequent consequence of a sedentary mode of living, unwholesome confinement in close, warm atmospheres, and

a too sedulous application to business, study, &c.; and finally how by the resulting imperfect oxygenation or decarbonization of the blood, that fluid passes through and from the lungs in a venous, contaminated state, engendering disease, into whatever part of the body it may flow.

Following the various parts of the process in rotation it will now be the proper time for speaking of the temperature of the wet-sheet. The numbers representing the state of the thermometer when disengaged from the sheet in each operation, beginning with the first will be on Fahrenheit's scale 93, 91, 93, 93, 90, 95, 95, 93, 92. The average amount deduced from these is 92.77° F. From this experiment of ascertaining the actual temperature of the wet-sheet we obtain several useful pieces of information.

In the first place we learn that the heat in the packing is pretty uniform, on whatever temperament it may be practised. It seems to vary only by a few degrees, the prevailing whole number being 93. The author has repeated this experiment in several cases of disease, for example in strumous inflammation of the glands of the neck, in dyspepsia, and in a case of chronic bronchitis, and he has found the same results within a few fractions of the second order. It may therefore be safely pronounced that in health and in ordinary chronic diseases, if the patient be well packed, the figures 92.77° F. about represent the average temperature of the wet-sheet; of course if the packing were injudiciously ordered in very debilitated constitutions, these might not be able to maintain an external temperature of that height. And on the other hand in acute febrile and inflammatory affections the thermometer placed in the sheet would mount still higher.

By reference to the details of the operations, and an observation of the remarks denoting the state of the various sensations of the bathers, it will be perceived that in operation 1. the thermometer stood at 93° F. and the person

felt warm. In operation 2. the therm. at 91° F. he was also warm and comfortable. In operation 3. the therm. being only at 93° F. he became quite hot. In operation 4. the therm. also at 93° F. he also became quite hot. In operation 5. the therm. at 90° F. he felt quite warm. In operation 6. the thermometer was five degrees higher than in last operation, yet he only felt warm. In operation 7. the therm. at 95° F. the bather, now a different individual, only felt moderately warm. In operation 8. the therm. at 93° F. he felt neither warm nor cold. In operation 9. the therm. at 92° F. he felt quite comfortable, but not decidedly warm. The author remembers distinctly that as a general principle the first person, namely, he of the sanguine temperament, described himself as warm long before the phlegmatic individual, and that the latter very frequently even when he was quite comfortable did not call himself warm. The latter never by any chance became hot.

From these experiments arise two general inferences. The first is, that in regard to the actual temperature outside the body in the wet-packing little reliance can be placed upon the patient's feelings, the sensations being in truth no guide whatever. The author has more than once, when invalids have complained of feeling cold in the sheet, and he has consequently expected to find the actual temperature lower than usual, been disappointed in discovering the mercury at 93° F. or thereabouts. The second inference is, that the difference of corporeal disposition makes no alteration in the thermometric, but considerable alteration in the sensational temperature. Enough on this subject for the present. It will again be briefly brought on the tapis by and by.

In the wet-sheet operation the next matter, that under other circumstances should be discussed, is the change of temperature effected upon the water in the shallow bath, but as this effect will be fully treated in the chapter devoted to the shallow bath, the author begs to refer the reader thither for its exposition.

We now arrive at *a*, if not *the*, most important point in this chapter, namely the alteration in weight produced upon the body by lying in the wet-sheet. It is, the author believes, at the present day (May 6th, 1850) universally understood that, if a person be allowed to remain sufficiently long in the wet-sheet packing, namely for two or three hours, it becomes a sudorific, a sweating process. At all events it was considered so by all to whom the author spoke upon the subject, and he spoke to many on purpose to gather the general opinion thereupon. Wishing to investigate this matter thoroughly, as he had his doubts about the accuracy of the fact, although he believes it to be the general opinion of hydropathic practitioners as well as the laity, he instituted a series of experiments. Those experiments are already before the reader. The conclusion he arrived at was, that it was quite a mistaken notion, and that the wet-sheet however long protracted is *not* a sudorific process under any circumstances. But this is a matter of such considerable interest to the physiological mind, and of such deep importance in the treatment of disease, that he hopes he shall not sue for pardon in vain, if his enquiry into it be rather minute.

How came it then to be commonly believed that a protracted wet-sheet packing reduced a person by perspiration? There were in the author's conception several reasons for this, some of a gross character and some very pardonable—and yet not pardonable, since no one should tamely take a thing for granted, of this serious consequence, but should rather invariably test its accuracy for himself. One reason at first and most superficial view plausible, but when sifted of a very ridiculous stamp is the following. When a patient first steps upon the wet-sheet he receives a sudden cold shock. The suddenness and coldness make so strong an impression upon him that he feels nothing else. But after ten or twenty minutes he feels warm, and now for the first time experiences a sensation of moisture.

Not having perceived this before, he erroneously ascribes it to exudation of fluid through his own skin. But the truth is he was just as moist before, but the more powerful impression of the cold shock had cloaked the sensation, or rather had prevented its being appreciated. The moisture now felt is nothing more than the water contained in the interstices of the sheet, and most unquestionably is *not* perspiration. Some of the readers of this work may think this circumstance too trivial, and too easily dismissed to be worth mentioning. But the author conceives himself to be right in alluding to it, as his own patients have frequently spoken of it to him as an argument in favour of a sudorific action in the wet-sheet.

Another cause, which is rather merely an extension of the first cause, and equally untenable, is that the patient when he leaves the packing *smokes* visibly. This smoke is often wrongly set down as perspiration. It is the same water, as aqueous vapor of course, detached from the sheet and adhering to the skin. A third argument on the side of this sudorific effect of the wet-sheet may be found in the fact that a frequent repetition, or prolonged use of it exercises a very debilitating influence. This debilitating influence is wrongly attributed to the actual abstraction of substance through the cutaneous pores. Now let the author be clearly understood. He does not assert or even think that any hydropathic physician believes in all these reasons. On the contrary he conceives that no person at all grounded in the principles of physiology could yield any credit to the former two. But he does say that the lay hydropathists frequently so misunderstand all three circumstances. With regard to the hydropathic practitioner all the author means to aver is, that he believes it to be the general opinion of that class, that when the wet-sheet packing is protracted beyond the usual period, which is enjoined to produce its antiphlogistic, anodyne, or slightly derivative effect, the latter property becomes

so strong as to convert a soothing, calming process into a sudorific one.

That this latter effect cannot be achieved the author has convinced himself in a most satisfactory manner. In the first place the forehead does not perspire, however long the packing may endure. Now in the blanket-packing, and in that kind of vapor bath, where the head is excluded from the vapor, the sign of the beginning, and establishment, and amount of perspiration, is observed on the forehead alone. As a general rule, when other parts of the body are exuding moisture, that particular locality, which is exposed to view, participates in that event. But in the wet-sheet packing, no matter how protracted, no moisture breaks out upon the forehead; whereby we are supplied with one powerful argument to enable us to judge of the non-sudorific character of this process.

Secondly, the weakening effect visiting the system from a too lengthened employment of the wet-sheet can be explained in a far more satisfactory manner than upon the hypothesis of perspiration. Allusion is made to its depressing effect upon the pulse. For as it has been plainly shown that this property through judicious management is capable of effecting most excellent results both in acute and chronic diseases, so also there can be no question that, where want of judgment is displayed, it can work the most deleterious influence. When a person's heart stops, we all know he is dead. And therefore it may be easily understood that the nearer his heart is to stopping, cœteris paribus, the nearer he is to death. Now if the practitioner exhibit skill and judgment, the patient, that is his heart, is never allowed to step beyond a certain boundary. It is neither permitted to fall too low, nor to be maintained in a low state for too long a time. Upon the supervention of the slightest symptom of exceeding the limit, the sheet is discontinued. Nor let the reader stand aghast at learning the fact, that the sheet engenders a condition

more allied to death. Let him not fear it on that account. For is not sleep of near kin to death?

> How wonderful is death,
> Death, and his *brother*, sleep.

Yet is no one afraid to trust himself to morpheus. In the same way let no one fear the sheet in competent hands.

After a certain extent of diminution of arterial pulsation, either in immediate amount or in this condition being prolonged, harmful consequences ensue. Very much the same effects result, as attend in ordinary circumstances a deficiency of muscular exercise. This want is productive of evil from its depriving the circulating organs of their stimulus to action. They consequently become feeble, and languid, and discharge their duty in a lazy, dilatory, inefficient manner. A precisely similar state of things is the necessary sequel to an injudicious application, or unwise prolongation of the wet-sheet. In both cases of course great debility follows, and all the corporeal functions are disturbed.

But let it be remembered that sometimes the physician *aims* at the production of this debility. Cases occur, when it is beneficial to weaken, to reduce a person. Be this however as it may, intentional or not intentional, the author attributes, he believes with fairness and justice, this debilitating effect, whenever it may be produced, not to any perspiration, but to the lowering effect manifested by the wet-sheet upon the heart and arteries.

A third reason now comes for the author's denying the existence of any sudorific quality in the wet-sheet, and which he conceives to be irresistible. It is derived from the acquisition of correct information concerning the actual weight of persons before and after the packing. To conduct this argument in as conclusive a manner as possible, in the nine preceding operations, (some of which endured for the same length of period that it required for the same persons in the blanket-packing to perspire pro-

fusely), the individuals were balanced as accurately as possible immediately before and immediately after each process. The loss of weight occasioned during each operation beginning at the first was as follows :—1 oz., $\frac{3}{4}$ oz., $1\frac{1}{4}$ oz., $1\frac{1}{4}$ oz., $2\frac{1}{4}$ oz., $2\frac{1}{2}$ oz., $3\frac{1}{4}$ oz., $1\frac{3}{4}$ oz., and $\frac{1}{2}$ oz.

The first operation lasted one hour, and the loss of weight was one ounce. The second lasted also one hour, and the loss was but three quarters of an ounce. The third lasted an hour and ten minutes, and the loss one ounce and a quarter. The fourth continued one hour and a half, still the loss was only one ounce and a quarter. The fifth continued an hour and forty minutes, occasioning a loss in weight of two ounces and a quarter. The sixth was nearly an hour longer in duration, namely continuing two hours and a half, yet the diminution of substance was only a quarter of an ounce more than in the last operation, to wit, two ounces and a half. This closes the list of operations performed on the same individual. The three last of the nine cases all endured the same length of time, viz. four hours. Nevertheless what great fluctuation is discovered in the loss of weight for the respective operations! The loss sustained in the first is three ounces and a quarter, in the second one and three quarters, and in the third only half an ounce. From these experiments therefore it would seem, as if great discrepancy in the duration of the packing does not *necessarily* make great discrepancy in the loss of weight. Although perhaps it may be considered as a general principle, that the longer the process be protracted, the greater the diminution of bulk sustained.

The following table will give a clear, comprehensive view of the duration of each process and the corresponding amount of loss of substance :—

No.	Duration of bath. h. m.	Loss of weight. oz.
1	1	1
2	1	$\frac{3}{4}$
3	1 10	$1\frac{1}{4}$
4	1 30	$1\frac{1}{4}$
5	1 40	$2\frac{1}{4}$
6	2 30	$2\frac{1}{2}$
7	4	$3\frac{1}{4}$
8	4	$1\frac{3}{4}$
9	4	$\frac{1}{2}$

If now the periods of the duration of each bath be added together, they will be found to amount to twenty hours and fifty minutes. And if all the quantities lost on the respective occasions be treated in the same way, they will yield a result of fourteen ounces and a half. This produces by a simple calculation an average of about seven-tenths of an ounce per hour, or rather more than five drachms and a half. But be it observed dictinctly, that when the sheet lasted only one hour, it diminished the weight in one case 1 oz. that is eight drachms, and in another three quarters of an ounce, that is six drachms. This of course produces an average of seven drachms. So that by a prolongation of the process the average loss of weight instead of increasing, absolutely diminishes. Hence the wet-sheet, however protracted, does *not* become a sweating process, unless indeed it be allowed that *without* this protraction, that is in ordinary circumstances it is a still more powerful sudorific! But no hydropathist for a moment entertains the notion that the wet-sheet is *usually* a sweating process!

Yet even if we consider seven drachms as the average loss of weight per hour (as deduced from the two first operations), we can most readily account for this deficit with-the entailment of diaphoresis. An adult man eats and drinks daily, but under ordinary circumstances does not increase in bulk. Why? Because as much as he takes

into his body, just so much is constantly quitting his body. The channels by which the food, having fulfilled its purpose in the economy, escapes therefrom, are the skin, the lungs, the kidneys, and the bowels. It was proved experimentally by a famous physiologist, M. Seguin, that of the secretions from these organs about thirty ounces passed daily through the skin in the shape of insensible perspiration. Here then is a perfectly correct and natural loss of substance from the skin of more than one ounce per hour. Does it not therefore necessarily follow that a person who loses merely an ounce, or seven drachms *in* the wet-sheet during an hour, would have lost as much, if not more, *out* of it?

From all these observations and experiments it appears to the author that four rules may be deduced—firstly, that the wet-sheet is accompanied by a slight loss of weight; secondly, that this loss of weight would have been produced without the wet-sheet; thirdly, that with increased prolongation of the period of packing the loss of weight does absolutely, but does not relatively increase; and fourthly therefore that the wet-sheet under no circumstances becomes a sweating process.

One excellent physiological reason may be rendered for the wet-sheet, although a warm bath, not producing perpiration. An ordinary sudorific bath, as the hot air-bath, the vapor-bath, and even the blanket packing, manifests its diaphoretic qualities in this manner. First, there is a hot atmosphere generated, which encircles the patient's naked body. This hot atmosphere gives rise to two important consequences. It rarefies, or relaxes the skin, thereby rendering that membrane more permeable to the passage of fluid. Secondly, it excites the heart and arteries to increased energy. These organs, being so stimulated, throw the blood into the skin with great vigor, and the skin, already softened and easily penetrable, and because too from weakness it cannot urge forward the blood with

the same energy with which it is assailed by it, opens wide its pores. Through these the more watery parts of that fluid freely transude, and thus the distended membrane is relieved.

Now it is true that by the wet-sheet the surface of the body is enveloped in a heated atmosphere. But the warmth of that atmosplere is produced so gradually, and is at all times so mild, that although it is capable of exerting a laxative influence on the skin, it certainly is not capable of stimulating the organs of circulation to augmented activity. The temperature of the wet-sheet is 92.77° F. This is considerably under blood-heat which is 98° F. The temperature of the vapor-bath usually rises to at least 105° F., frequently to 110° F., and sometimes considerably higher. The hot-air bath ranges quite as high. With regard to the blanket-packing the author has not yet performed any thermometric experiments. He expects the rule will be found to be, that no temperature below that of the interior of the body (98° F.) applied to the surface is capable of so exciting the heart and arteries, as to produce perspiration, unless perhaps it be applied suddenly. He has no means at present of demonstrating the truth of this statement, but in the mean time ventures to propound it as a very tenable theory.*

* This opinion, developed merely as a rational theory, is now singularly confirmed by the thermometric experiments performed on the process of the blanket-packing. On referring to the chapter devoted to that operation it will be perceived that the temperature of the atmosphere enveloping the body is invariably above that of blood heat, and therefore capable of exciting the organs of circulation to such energetic action, as shall produce with the aid of an already relaxed skin a flow of perspiration.

CHAPTER III.

THE DOUCHE.

In reference to this bath, for obvious reasons there is not the same field for investigation and experiment, as there is for those of a more complicated character, as the wet-sheet packing, and blanket-packing. The author has confined himself entirely to the observation of its effects upon the pulse, that is the arterial system, and the respiration. To speak first of the former, a man weighing ten stones eleven pounds, about forty years of age, of an elastic, buoyant disposition both of mind and body, received the douche of twenty-five feet fall at three p.m., (one hour after dinner) for one minute on five successive days in the winter, with the following results:—

FIRST SERIES OF OPERATIONS.

	Pulse before the bath.	Pulse after the bath.
1	88	120
2	96	124
3	116	122
4	86	132
5	100	120
	5)—486 total.	5)—618 total.
	97.2 average.	123.6 average.

In this series it will be seen, that the pulse was invariably accelerated by the douche, and that the average rate of speed before the operation was 97.2, and that after it 123.6. This shews an average elevation of 26.4 in the minute, for

97.2+26.4=123.6. So much for this individual. In him the elevation of pulse was constant.

Another man weighing ten stones eight pounds, (of a similar weight therefore,) but of a most inelastic, non-buoyant disposition, either corporeal or mental, and about thirty years old, was subjected to the same douche for the same time, but with very different effects, as the succeeding figures will shew :—

SECOND SERIES OF OPERATIONS.

	Pulse before the bath.	Pulse after the bath.
1	92	74
2	84	84
3	104	94
4	96	96
5	104	80
6	106	90
7	100	96
8	104	84
9	96	80
	9)—886 total.	9)—778 total.
	98.44 average.	86.44 average.

Hence it will be seen that, whereas in the first series of operations there was an habitual increase in the number of pulsations, in the present series, performed upon a different person and one of a different temperament, there is just as uniform a diminution. And this too even although the average rapidity of the pulse before the operation was in both cases nearly identical, being in the one 97.2, and in the other 98.44.

The amount of fall in the instance before us will be just 12, for 86.44+12=98.44.

A month afterwards the same individual was again subjected to the influence of the douche. And curious to

relate, precisely the opposite effect on the pulse was manifested. He took the douche four times, and on every occasion the speed of the artery increased, as will be seen in the subjoined table.

THIRD SERIES OF OPERATIONS.

	Pulse before the bath.	Pulse after the bath.
1	64	96
2	56	96
3	80	84
4	88	108
	4)—288 total.	4)—384 total.
	72 average.	96 average.

96—24=72. Here therefore is presented a *rise* in the pulse of 24 beats in the minuute. And yet there have just been brought before the reader's eyes a series of experiments performed only one month before on the same individual in the same state of health, &c., where there was exhibited a *fall* in the pulse of 12 beats in the minute. What is the reason of this incongruity? In the present infancy of scientific hydropathy the author confesses his ignorance on this point. And as this is essentially a work of practical research he will not introduce an hypothesis. He has not the slightest doubt however that further experimental investigation will speedily unravel the mystery.

Besides increasing or dimishing the rapidity of the pulse the douche produces sometimes a very decided change in the character of the artery. Thus in No. 4 of the first series of operations above detailed the pulse not only was extremely accelerated, but enlarged in *size*, became much *fuller*, and pressed the finger in a bounding elastic manner. In No. 5 of the same series it also expanded most conspicuously under the influence of the douche. In Nos. 4, 5,

and 6 of the second series an opposite condition was induced. The calibre of the pulse was palpably diminished. The artery became *contracted.* This effect, *contraction,* the author has frequently observed in the employment of other hydropathic processes, as the shallow bath, the can-douche, and so forth.

It now remains to examine the influence exerted by the falling column upon the lungs. For this purpose the same person was employed as he, upon whom the last two series of operations were performed, and indeed at the same time, that is to say as far as they went. The details of this experimentary investigation are placed below, as follows:—

FOURTH SERIES OF OPERATIONS.

	Pulse before bath.	Pulse after bath.		Resp. before bath.	Resp. after bath.
1	104	84	falling.	20	24
2	96	80		20	20
3	100	96		22	28
4	64	96	rising.	17.5	32
5	56	96		20	32
6	80	84		24	32
7	80	108		20	36
			Total	7)—143.5.	7)—204.
			Average	20.5	29.14.

The reader will at once perceive here, that with one exception there is constant increased rapidity of breathing. In that exception it remains from some casualty unaffected. The average acceleration in the minute is 8.64 undulations of the chest, for 29.14—8.64=20.5.

The conditions of the *pulse* also have been inserted to shew clearly, that the falling or rising of the rapidity of that artery in no way influences the effect upon the respiration, which indeed (with of course an exception here and there) the author believes to be uniformly accelerated.

The present uniformity too is the more striking, inasmuch as the last four experiments were performed a month after the first three, a fact which induced such a contrasting difference in respect to the pulse.

Three confirmatory experiments were performed on a young man, twenty years of age, of a sanguine temperament, and weighing eight stone. They are thus arranged in a tabular form :—

FIFTH SERIES OF OPERATIONS.

	Pulse before bath.	Pulse after bath.	Resp. before bath.	Resp. after bath.
1	88	96	22	24
2	96	84	24	26
3	96	80	24	28
Total	3)—280	3)—260	3)—70	3)—78
Average	93.33	86.66	23.33	26

In this series, although the pulse is variable, once becoming more rapid, and twice more slow, the respiration always is increased. The average amount of additional speed is 2.67 in the minute, since 26—2.67=23.33.

The average rapidity of the pulse before the bath was 93.33. After the bath it was 86.66. This produces a diminution of 6.67, for 93.33—6.67=86.66.

Analysis of the Douche Operations.

It should be mentioned that the douches employed by the author presented a column of water falling about twenty-five feet, or a little more. As a general rule a fall of from twenty to five and twenty feet is sufficient to answer every purpose. By "fall" of course is not meant the distance from the extremity of the pipe to the person bathing, but the length of the descent all the way from the spring, or source of the water. It does not signify at all how near

the bore of the tube, whence issues the stream, is to the floor of the apartment, as regards the power or efficacy of the douche. As long as it is high enough to admit a man of any height beneath it, that is quite sufficient. Indeed the mouth of the pipe should not be too high, as the glassy, columnar form of the falling water under such circumstances is generally less perfect than otherwise. It is apt to become less solid, less compact, more splashing, and irregular before it reaches the body of the bather.

The diameter of the column should be diversified. The author has six douches, the pipes varying in calibre from one inch to two inches and a half. So that he has the power of varying the dose, just the same as a medical gentleman can vary his dose of opium. Of course a body of water two inches thick must abstract more heat from a person upon whom it descends, than one of only one inch diameter. It must therefore be capable of producing a more energetic effect. And if it be capable of producing a more energetic effect in one circumstance, namely, the withdrawal of animal heat, it must also have greater power in other matters, as in its influence upon the circulation, respiration, &c. In other words it is a larger dose.

The first series of experiments had reference to the pulse alone. So also with regard to the six first of the second series. Because at the time that those operations were performed, it had not yet occurred to the author to investigate the effect of hydropathy upon the organs of respiration, the lungs. But after that period, in making experiments upon the douche, the arterial and pulmonary systems were always associated together. For an account of the states of the respiratory process corresponding to the three last operations of the second series, and all those of the third, let the reader consult the details of the fourth series.

Of the four series of operations that had reference to the pulsation of the heart and arteries, namely the first, second, third, and fifth, it will be perceived that this function was

augmented in rapidity twice, and diminished in rapidity the same number of times. These four sets of experiments were performed on three individuals, two of them consequently being performed on the same person. On the first occasion of the douche operations being undergone by this person, namely as exhibited in the second series, the pulse *fell*. On the second occasion, as shewn in the third series, the pulse *rose*. This person was of a dull, phlegmatic temperament, the other two being of an elastic, sanguine disposition. Here then are two persons of a sanguine temperament acted upon by the douche in a different manner. One has his pulse exalted, the other's is retarded. And here is also a single individual, whose circulation is at one time accelerated, at another, although only after a month's interval, diminished in rapidity. Hence it follows that there is no rule for any specific effect manifested by the douche upon the heart and arteries. Its influence upon them appears to be regulated by external circumstances, of the nature of which we are at present perfectly ignorant.

With the respiration however it is a totally different affair. Not only in every series of experiments, but in every individual experiment, but one, this function was accelerated. The exception is observed in the second experiment of the fourth series of operations. It appears that here the respiratory movements numbered twenty, both before and after the bath. In the above-mentioned series the average respiration per minute before the bath, was 20.5. After the bath it was 29.14. This betokens a difference of 8.64 additional thoracic movements. In the fifth series of operations the average respiration before the bath was 23.33, that after it 26 per minute, the elevation therefore amounting to 2.67. Out of ten experiments in *none* was the respiration diminished, in *nine* it was raised, and in *one* it remained stationary.

As a general rule, therefore, it may be considered that the douche affects the pulse in different ways, sometimes

raising it, and sometimes depressing it, but that the respiration is always influenced in the same direction, namely in being accelerated.

The beneficial effects resulting from this physiological arrangement can scarcely be exaggerated. Sufficient has been said in the first and second chapters concerning the advantage accruing to an increased activity in the respiratory process, independent of, and unaccompanied by the same augmentation in the pulsation of the heart and arteries.

But it may perhaps now occur to the reader that in those cases of the douche application, where additional frequency of the pulse is associated with the exalted respiration, these before-mentioned excellent results would be neutralized. Far however is this from the fact. Let the reader refer to the fourth series of operations. He will there discover, that rise as the respiration does when the pulse falls, it rises infinitely higher, when there is any augmentation in the latter. And it is on account of this increased rapidity in both circulation and respiration together, that of the last-named prevailing in extent over the first, that the peculiarly exhilarating, buoyant effect, so frequently following the douche, is occasioned. The author will endeavour to explain this clearly.

Man is constantly in a state of change. In this respect he resembles every thing around him—the state of society—the world—the whole universe. It is essential to his existence and to his health. Every part of his body is continually undergoing transformation. New tissue is being perpetually laid down, and old tissue perpetually carried away. It is the maintenance of this process of repair, as it may be called, in a well-regulated manner, that constitutes the blessing of health. And it is by the blood that these tissues are deposited, and by the blood also that, when they have discharged their office in the animal economy, they are removed. Now it is the heart

and arteries that transmit the blood thither, and for that object; and it is the lungs that effect the purification of that fluid, thereby rendering it fit for the office. Hence it follows that the more blood that there is conveyed to a part, and the purer it is in its nature, the more quickly and the more efficiently this state of change, this repairing, is conducted. And the more the activity of the heart, blood-vessels, and lungs is stimulated, the more and the purer the blood will be, that is so transmitted for the construction and demolition of tissue, that is, to effect the healthy change. But the douche produces this effect, imparting vigor and rapidity as it does to the organs of circulation and respiration. Ergo, as perfect health consists in the correct fulfilment of this repairing function, the douche may be said to approximate a man's condition to that inestimable and almost unknown blessing, perfect health. Hence those light elastic feelings, that gladsome exhilaration, that pleasing aspect of worldly things, that spirit of buoyancy both in body and mind, that so frequently follow this invaluable bath. In fact, for the time being the person may be said to enjoy perfect health. Yet so strange is it to him, who has never known this happy state, (and who in the present day does know it?) that he cannot understand it. According to our general and civilized notion of health, it may with propriety be looked upon as *excess of health.* Thrice happy the man, however, in whom this excess may be allowed to grow and flourish!

Such excellent results not uncommonly attach themselves to the hydropathic treatment generally, independent of the douche. When this is the case, it is for the same reason, applied of course to some other bath or system of baths. But, as before mentioned, the douche is the one after which this felicitous condition is most marked.

Now were the pulse alone accelerated, or the pulse and respiration merely accelerated in an equal degree, the results would not be so successful. For under the cir-

cumstances of the first case more blood would be driven into the lungs than those organs (their activity not being increased in a manner corresponding to that of the heart) would be capable of purifying. It would therefore it is true be carried to the tissues in greater abundance than before, but it would be in an impure, un-decarbonized state. So far therefore from being in a fit state to invigorate the change of matter, by its unhealthy properties it would be calculated to retard that function. Under the circumstances of the second case, namely where the circulation and respiration are promoted in an equal degree, a certain amount of good beyond a doubt would be achieved. More blood (not deteriorated in quality, as in the last-mentioned instance) would be circulated, or rather there would be a more frequent accession of blood to the various structures. And this without question would be attended with benefit. Yet the great thing of all would be wanting —the additional purity of the blood. The latter of course is only to be acquired by the activity of the lungs being excited still more than that of the organs of circulation. Now if the reader will have the goodness to refer to the fourth series of operations, he will not only perceive that however the pulse fluctuates, the respiratory process always (except once) becomes quickened, but he will discover moreover that, when and however much the circulation may be accelerated, the number of times of breathing, will be, not actually of course but, proportionally still more accelerated. Hence therefore under the influence of the douche not only is the blood conveyed into the different structures with greater freedom, but that fluid is also of a better quality, more rosy, more full of oxygen, more fit for its all-important duty, and capable of producing a better material in the frame-work of the body. Hence also follows that incomparable feeling of a better existence, to which the author has before alluded.

Probably the reader has either inhaled himself, or wit-

nessed the effects of its inhalation in others, that well-known intoxicating agent, laughing gas. This aëriform fluid is composed of one atom or equivalent of oxygen, and the same amount of nitrogen, chemically united. Its constituent elements therefore are very nearly the same as those of common atmospheric air. But there is this great difference; whereas in the air we generally breathe there is only present one part of oxygen for four of nitrogen, in the laughing gas, or protoxide of nitrogen, as it is designated in chemical language, these ingredients are combined in equal proportions. Now the author believes he has somewhere in this work already mentioned, that the object of the existence of nitrogen in the atmosphere we breathe, is merely for the sake of diluting the oxygen—that it fulfills no useful purpose itself in the functions of the animal economy—and that the last-named gas, if undiluted, so far from being of vital service in the maintenance of health, would speedily put a period to existence. But when oxygen is diluted with only one equivalent of nitrogen, as is the case with laughing gas, it does not, when inspired, produce so quickly a fatal effect. It speedily however generates slight intoxication. And this intoxication is remarkable for being of a pleasant description. Whatever strange fancies, or feelings may spring out of it, they are nearly always of an agreeable character. It is from the fact of immoderate fits of laughter, (which itself is a proof of the happy frame of mind of the individual under its influence) so frequently resulting from its employment, that it has received the soubriquet of "laughing-gas." One of the commonest ideas that arise is that the person is lifted off his feet, and soars among the clouds on pinions. Another places him in the Elysian fields with his attendant houri. But whatever wild thoughts flit through the imagination, they are for the most part of an exceedingly happy nature.

Now the douche in its effects may be likened to laughing

gas, but of course in a modified and infinitely milder form. And laughing-gas may be likened in its results to the douche much intensified. But as the sublime, and the ridiculous stand separated only by a slight intervening space, so the results manifested by this gas and those manifested by the douche, so similar in their nature, represent respectively,—the first disease—the second perfect health. The reason that the first amounts to disease, while the other does not go beyond the limit of health, is two-fold.

Firstly, in the case of laughing-gas, there is a larger quantity of oxygen admitted *suddenly;* secondly its quantity is *excessive.* By means of the douche neither can its quantity be excessive, nor can imperfectly diluted oxygen be admitted at *all,* suddenly or otherwise. Whereas, if the effects of the laughing-gas were to continue, they would prove fatal, the buoyancy and elasticity imparted by the douche not only may continue without injury to the system, but will of course prolong life.

CHAPTER IV.

THE DRY OR BLANKET-PACKING.

THE following operations were performed on the same persons as the wet-sheet packing. For an account therefore of their natural constitutions and other peculiarities the author begs to refer the reader to the last-mentioned process.

The apparatus consisted of six blankets and a feather bed.

To ascertain the temperature of the bath as accurately as possible a thermometer was placed at the commencement of the packing over the arm, but separated from the skin by one thickness of blanket.

If the reader will refer to the preliminary remarks affixed to the description of the wet-sheet packing, there will be no necessity for further explanatory observations in this place. Merely remarking then, that the first six operations were undergone by the man of phlegmatic temperament, and the remainder by him of the excitable one, I shall at once detail the experiments.

FIRST SERIES OF OPERATIONS, PERFORMED ON AN INDIVIDUAL OF PHLEGMATIC TEMPERAMENT.

OPERATION I.

of four hours' duration.

	Pulse, per minute.		Respiration, per minute.	
Before the process...	92	......	19	
After 1 hour	60	......	16	feels warm but not moist.
After 2 hours.........	60	......	16	
After 3 hours	60	......	16	feels warm and is beginning to feel moist.

	Pulse, per minute.	Respiration, per minute.	
After 4 hours	70	18	The forehead is beaded with drops of perspiration. He feels in a profuse perspiration.
In shallow-bath ...	60	—	
In drying-sheet ...	72	—	

Temperature outside the blanket nearest to the skin 102° F.

Temperature of the water in the shallow-bath raised from 49.75° F. to 52.50° F.

	st.	lb.	oz.
Weight prior to the operation.........	10	11	$11\frac{1}{2}$
Weight subsequent to the operation	10	10	$14\frac{3}{4}$
Loss...			$12\frac{3}{4}$

The behaviour of the pulse and respiration in this operation is curiously symmetrical with regard to each other. It will be seen that the second, third, and fourth figures in the first column are the same, and the corresponding figures in the second column also the same, and that both trios are of a lower denomination than the figure at the head of the row. The pulse fell 32 beats in the minute before the expiration of the first hour and remained at the same point till after the expiration of the third hour, and till the bather was beginning to perspire. It then rose ten beats. The respiration sunk in the same manner from nineteen to sixteen (which be it remembered is not near so much in proportion) before the termination of one hour, and continued at sixteen to the end of the third, when it increased simultaneously with the pulse. The effect of the shallow-bath and drying-sheet upon the respiration the author was unavoidably prevented from ascertaining in this operation.

While the pulse subsided 32 beats out of 92, that is

more than $\frac{1}{3}$ the original number, the respiration was diminished only 3 in 19, that is less than $\frac{1}{6}$ the original number. In proportion to the pulse this is less than half to one.

Operation II.

Of four hours' duration.

	Pulse, per minute.		Respiration, per minute.	
Before the process...	80	......	18	
After 1 hour	50	......	15	
After 2 hours.........	53	......	17	
After 3 hours.........	56	......	17	no perspiration yet.
After 4 hours.........	60	......	17	forehead beaded with
In shallow-bath......	60	......	17	drops of perspira-
In drying-sheet......	64	......	17	tion; feels in a profuse perspiration.

Temperature outside the blanket nearest to the skin 102° F.

Temperature of the water in the shallow-bath raised from 47° F. to 49° F.

	st.	lb.	oz.
Weight prior to the operation.........	10	12	$7\frac{1}{2}$
Weight subsequent to the operation	10	11	4
Loss...		1	$3\frac{1}{2}$

It is interesting to observe, that in this operation and the last there is nearly the same amount of subsidence of the pulse, viz., in the one case 30 and in the other 32 beats in the minute, at the expiration of the first hour, although there is a wide difference between its rapidity before the process in the two instances. It is still more curious to discover that precisely the same thing occurs with regard to the respiration, and with still greater exactitude. But here the

analogy between the two operations ceases. Whereas in the first both pulse and respiration remained at a standstill for three hours: in the last they began to quicken after the first hour, the pulse continuing to do so, but the respiration becoming stationary after the first elevation, and remaining so to the end of the process, during four consecutive experiments.

Operation III.

Of four hours' duration.

	Pulse, per minute.		Respiration, per minute.	
Before the process...	72	......	24	
After 1 hour	50	......	18	
After 2 hours..	48.5	.. ...	16	
After 3 hours.........	51.5	......	18	
After 4 hours.........	60	.....	18	forehead beaded with
In shallow-bath	60	......	18	drops of perspira-
In drying-sheet	72	......	20	tion.

Temperature outside the blanket nearest to the skin 102° F.

Temperature of the water in the shallow-bath raised from 50.75° F. to 52.75° F.

	st.	lb.	oz.
Weight prior to the operation.........	10	10	9
Weight subsequent to the operation	10	10	3
Loss...			6

Operation IV.

Of four hours' duration.

	Pulse, per minute.		Respiration, per minute.
Before the process ...	92	......	19.5
After 1 hour	62	......	17
After 2 hours.........	60	......	17
After 3 hours.........	58	......	17

	Pulse, per minute.		Respiration, per minute.	
After 4 hours.........	66	......	17	forehead beaded with
In shallow-bath	60	......	21	drops of perspira-
In drying-sheet	72	......	24	tion.

Temperature outside the blanket nearest to the skin 102° F.

Temperature of the water in the shallow-bath raised from 52.50° F. to 54.50° F.

	st.	lb.	oz.
Weight prior to the operation.........	10	10	$15\frac{3}{4}$
Weight subsequent to the operation	10	9	$13\frac{3}{4}$
Loss ..		1	2

Operation V.

Of four hours' duration.

	Pulse, per minute.		Respiration, per minute.	
Before the process...	76	......	24	
After 1 hour	56	......	19	neither warm nor cold
After 2 hours.........	54	......	19	*i.e.* tolerably warm.
After 3 hours.........	56	......	19	feels moist all over.
After 4 hours.........	68	......	34	forehead beaded with
In shallow-bath	72	......	24	drops of perspira-
In drying-sheet	84	......	28	tion, face red, and
				veins turgid.

Temperature outside the blanket nearest to the skin 101.5° F.

Temperature of the water in the shallow-bath raised from 53.75° F. to 55.00° F.

	st.	lb.	oz.
Weight prior to the operation............	10	11	$0\frac{1}{4}$
Weight subsequent to the operation	10	10	$4\frac{1}{4}$
Loss....			12

Operation VI.

Of four hours' duration.

	Pulse, per minute.	Respiration, per minute.	
Before the process....	84	21	comfortable, but not
After 1 hour	57	16	getting moist. [warm.
After 2 hours............	56	18	
After 3 hours............	56	18	
After 4 hours............	64	18	forehead beaded with
In shallow-bath........	72	22	drops of perspira-
In drying-sheet	84	22	tion.

Temperature outside the blanket nearest to the skin 102° F.

Temperature of the water in the shallow-bath raised from 54.75° F. to 56.00° F.

	st.	lb.	oz.
Weight prior to the operation............	10	7	$10\frac{3}{4}$
Weight subsequent to the operation	10	6	14
Loss....			$12\frac{3}{4}$

The foregoing six operations were undergone by the same person, viz., him of the phlegmatic constitution, to whom frequent allusion has been made. Those that follow were conducted on a different individual, and one, as before-mentioned, of an excitable temperament.

SECOND SERIES OF OPERATIONS PERFORMED ON AN INDIVIDUAL OF SANGUINE TEMPERAMENT.

Operation VII.

Of two hours and a half's duration.

	Pulse, per minute.	Respiration, per minute.	
Before the process....	116	22.5	
After 1 hour	71	21	feet perspiring, generally warm and moist.
After 2 hours...........	77	19	feels quite hot and perspiring all over, bead-like drops on the forehead.
After $2\frac{1}{2}$ hours	80	20	perspiration running down the face.
In the shallow-bath	88	....	
In drying-sheet	132	....	

Temperature outside the blanket nearest to the skin 99° F.

Temperature of the water in the shallow-bath raised from 51.00° F. to 52.00° T.

	st.	lb.	oz.
Weight prior to the operation	7	13	$8\frac{1}{2}$
Weight subsequent to the operation	7	12	$15\frac{1}{2}$
Loss....			9

In this operation is extremely well shown how the effect of the different parts of the process may be modified by the natural temperament of the individual. The nervous impressionability of the present bather is illustrated by the contrasting variations of the pulse, and particularly by its exalted state at the termination of the process. It is here seen to be *sixteen* beats higher than at the commencement,

unusually high as it even then was. In operation II. a precisely contrary condition of things will be noticed. In that example the process commences with a pulse beating *eighty* times in the minute, and terminates with *sixty-four.* It has fallen just *sixteen* beats! But then the natural disposition of the man, physical and mental, was phlegmatic, or if the author may be permitted without offence an exceedingly apt expression, cold-blooded. Hence beyond a doubt it follows, that the effect of hydropathic measures may be very much modified by the inherent temperament of the individual.

Operation VIII.

Of two hours and a half's duration.

	Pulse, per minute.		Respiration, per minute.
Before the process....	97	....	22
After 1 hour	70	....	17.5
After 2 hours...	72	....	20
After $2\frac{1}{2}$ hours	72	....	20 forehead beaded.
In shallow-bath	84	....	28
In drying-sheet	120	....	

Temperature outside the blanket nearest to the skin 101° F.

Temperature of the water in the shallow-bath raised from 51.00° F. to 52.00° F.

	st.	lb.	oz.
Weight prior to the operation	8	0	$9\frac{1}{4}$
Weight subsequent to the operation....	8	0	1
Loss....			$8\frac{1}{4}$

The fluctuation of the pulse again in this operation, namely the primary depression of 27 beats below, and the

final elevation of 23 beats above, the original amount of speed per minute, denote unmistakeably the *impressionability* of this bather's constitutional temper.

Operation IX.

Of two hours and a half's duration.

	Pulse, per minute.		Respiration, per minute.	
Before the process....	100	....	20	
After 1 hour	66	....	22	
After 2 hours...........	74	....	30	beginning to perspire generally.
After $2\frac{1}{2}$ hours	76	....	32	forehead beaded with
In shallow-bath........	80	....	28	drops of perspira-
In drying-sheet........	104	....	32	tion.

Temperature outside the blanket nearest to the skin 100° F.

Temperature of the water in the shallow bath raised from 53.00° F. to 54.00° F.

	st.	lb.	oz.
Weight prior to the operation	8	0	$14\frac{3}{4}$
Weight subsequent to the operation	8	0	$8\frac{1}{4}$
Loss....			$6\frac{1}{2}$

On casting an eye over the figures of this operation, the reader will be at once struck with a great peculiarity and exception to the general rule. The author alludes to the exalted numbers under the head of respiration, where it will be observed, that, contrary to hitherto experience, all the other figures exceed in magnitude the first, viz. that which speaks of its rate of performance before the commencement of the process.

Operation X.

Of two hours and a half's duration.

	Pulse, per minute.		Respiration, per minute.	
Before the process....	104	....	25	
After 1 hour	70	....	24	
After 2 hours...........	76	....	21	forehead beaded
After $2\frac{1}{2}$ hours	92	....	30	with drops of per-
In shallow bath........	88	....	26	spiration.
In drying-sheet	106	....	28	

Temperature outside the blanket nearest to the skin 100° F.

Temperature of the water in the shallow bath raised from 53.00° F. to 65.50° F.

	st.	lbs.	oz.
Weight prior to the operation...........	7	13	$10\frac{3}{4}$
Weight subsequent to the operation.	7	13	3
Loss........			$7\frac{3}{4}$

Operation XI.

Of two hours and a half's duration.

	Pulse, per minute.		Respiration, per minute.	
Before the process....	96	....	21	
After 1 hour	64	....	19	feet quite cold.
After 2 hours...........	73	....	26	warm all over.
After $2\frac{1}{2}$ hours	72	....	30	forehead beaded with
In shallow bath	96	....	36	drops of perspira-
In drying sheet	100	....	28	tion.

Temperature outside the blanket, nearest the skin, 100° F.

Temperature of the water in the shallow bath raised from 55.00° F. to 56.00° F.

	st.	lbs.	oz.
Weight prior to the operation...........	8	1	$4\frac{1}{4}$
Weight subsequent to the operation.	8	0	$13\frac{1}{4}$
Loss....			7

Analysis of the Dry-Packing Operations.

The rapidity of the pulse *before the commencement* of the process of packing for the whole eleven operations is represented by the following figures beginning with the first and ending with the last, 92, 80, 72, 92, 76, 84, 116, 97, 100, 104, 96, each one signifying the number of beats per minute. These figures produce an average for each operation of 91.72 pulsations for each operation.

The rate of speed of the pulse *after the first hour* will be represented beginning with the first operation thus, 60, 50, 50, 62, 56, 57, 71, 70, 66, 70, 64. And these figures yield an average of 61.45 beats per minute for each experiment. Hence between the commencement of the packing and the termination of the first hour there occurs a subsidence in the heart and arteries of 30.27 beats in the minute. And this may with fairness be considered the average depression of the pulse in the blankets, when the pulse before the process ranges as high as 91 or 92. To proceed however with the description of the effect of these operations upon the circulating organs it will be necessary now to separate them into two divisions, viz. according to the temperament of the individuals receiving them. For it will be discovered that in the first six operations the pulse at the termination of the second hour is about the same as, indeed rather lower than, at the end of the first, whereas in the last five the pulse will average less rapidity at the end of the first hour than at the end of the second.

By and by this will be shewn to be a matter of considerable importance.

The figures representing the rapidity of the pulse in the first six operations at the end of the second hour are 60, 53, 48.5, 60, 54, 56. These will manifest an average of 55.25 for each operation. In the same operations at the termination of the first hour, the figures, (which are to be separated from the list in the last paragraph,) are as follows:—60, 50, 50, 62, 56 and 57. Of these the average pulse for each operation would be 55.83. Hence it appears that in these operations between the first and second hour there was a variation in the minute of only fifty-eight hundredths of a beat! Not so however with regard to the remaining five operations.

The figures in the latter denoting the rate of speed of the pulse per minute at the termination of the *first* hour are 71, 70, 66, 70, and 64. The average for each operation resulting from them is 68.20. Now the figures that represent the state of the pulse after the *second* hour are higher, as will be seen in the following, 77, 72, 74, 76, 73. These produce an average of 74.40. Hence therefore in these operations upon the sanguine temperament there is an *elevation* at the end of the second hour of 6.2 beats in the minute. In the first six processes however there was under the same circumstances a *diminution* of $\frac{58}{100}$ of a beat. What is the reason of this discrepancy? We shall see immediately.

In the six first operations the numbers of the pulsations of the heart after *three* hours were respectively 60, 56, 51.5, 58, 56, 56. Here is seen for each operation the average 56.25. So that, the corresponding amount at the termination of the second hour being 55.25, there is thus revealed an increase of one beat in the minute. What is the meaning of this increase? We shall see immediately.

At the conclusion of the packing the pulse in the same operations stood thus, 70, 60, 60, 66, 68, 64, manifesting

a much higher average than at any previous hour since the commencement of the process, to wit 64.66. It has therefore risen since the last examination no less than 8.41 beats in the minute.

The last five operations continued only two hours and a half. The figures therefore, that must be compared with those of the last paragraph, are those representing the pulse at the termination of that period. They are these, 80, 72, 76, 92, 72. The average derived from these numbers will be 78.40. The average rapidity of pulse after the second hour in these operations was 74.40. Here then is a farther elevation of 4 beats in the minute. What signifies this elevation of the pulse at the finale of both divisions of the experiments equally? We shall see immediately. In the meanwhile every one of these results is possessed of such high physiological interest, that the author is induced to arrange them in a tabular form, in order that the reader's eye may comprehend the whole at a glance.

	FIRST SERIES.	SECOND SERIES.
	Average state of the pulse per minute.	
Before the process	82.66	102.60
After one hour	55.83	68.20
After two hours	55.25	74.40
After two hours and a half	——	78.40
After three hours	56.25	——
After four hours	64.66	——

On inspecting this table the thing, that will probably and immediately arrest the reader's attention, will be the simultaneous depression in both series at the expiration of a single hour. In the first series this diminution amounts to 26.83 pulsations in the minute. In the second it reaches the still more considerable number, 34.40. What can be the cause of this very great subsidence? By referring to the details of the experiments the reader will see, that up

to this period no particular notice has been taken of any *sensations.* Indeed this matter has been mentioned but four times at the conclusion of the first hour. The first report was to the effect that the patient was "warm, but not moist," the second that the patient was "comfortable but not warm," the third that the "feet were perspiring," and the body was "generally warm and moist," and the fourth that "the feet were quite cold." It may be stated therefore as a general result, that as yet, with regard to the sensations, no particular effects had been produced. The author in consequence at once attributed this universal and strongly-marked reduction of the pulse to the *horizontal position and perfect quietude* of the body, that were of course maintained.

To confirm this view the author had recourse to the following personal experiment. He first stood up perfectly erect for five minutes, after having been previously engaged in writing, and therefore of course in the sitting posture. He then, having first noted the state of the pulse at the expiration of the five minutes, sat down for the same length of period. He then again examined his pulse, and finally lay down for five minutes. Having counted his pulse a third time he repeated the whole thing. By the way he omitted to say that he instituted the same inquiries into the state of his respiration. This was about the 23rd of February. A week afterwards he repeated the experiments. The results obtained from the two operations may be arranged in a tabular form together.

FIRST EXPERIMENT, FEB. 23RD.

	Pulse.	Respiration.
After standing 5 minutes	67	13
After sitting 5 minutes	60	15.5
After lying 5 minutes	48	15
After standing 5 minutes	64	16
After sitting 5 minutes	54	18
After lying 5 minutes	49	15

SECOND EXPERIMENT, MARCH 1st.

	Pulse.	Respiration.
After standing 5 minutes	72	18
After sitting 5 minutes	68	17.5
After lying 5 minutes............	56	15
After standing 5 minutes	68	17
After sitting 5 minutes	61	15
After lying 5 minutes............	54	12.5
After standing 5 minutes	66	18.5

It will be perceived in both these experiments, that in a comparison of the three postures, beginning of course with the standing one, and embracing the two next following, the pulse is *invariably* the most rapid in the erect position and the least so in the recumbent one. This is the *undeviating* rule then, most satisfactorily and unequivocally proved—that cœteris paribus, if a person who has been standing sits down, without any other influence his pulse falls, and if he then lie down, it falls still lower—and of course vice versa, if a person, who has been reclining, rise into the sitting posture, his pulse is elevated, and if he then stand up erect, it is still more elevated. And this is quite independent of the temporary excitement of moving. For expressly to obviate this objection, the pulse was on no occasion examined till after the expiration of five minutes, that is, till after such a time as that all such excitement would be allayed, and perfect quietude of body, whatever posture it should assume, would be ensured.

In these physiological effects produced by posture the respiration does not share with the pulse its remarkable constancy. Yet the author has little doubt that the same general rule holds good with regard to the lungs, as to the arterial system. In the second experiment the reader will observe that these organs obey the same rule in every respect as perfectly as the pulsation of the heart. But in the preceding operation there certainly exists considerable discrepancy in this matter with the respiratory process.

As resulting from these experiments the author entertains not the remotest hesitation in announcing his conviction, that the great depression of the pulse experienced after lying for the first hour in the blanket-packing is due entirely to the effect of posture, and of posture alone. And in the first series of operations the still further subsidence of the pulse at the end of the second hour is beyond a question to be ascribed to a continuation of the same influence.

Having now dispatched these matters it is time to answer the question, "What is the reason that at the termination of three hours in the first series, and of two hours in the second series of operations, there is manifested a most unequivocal acceleration of the pulse?" The solution is most easy. The author endeavoured so to arrange the period of lying enveloped in the blankets, and so to adapt it to the constitution of each individual, that in both cases the time of duration of the *sweating* should be as nearly as possible the same. And he believes he succeeded in this object, the time the perspiration lasted being about three quarters of an hour. Now that perspiration is both produced and maintained by increased activity of the heart and arteries, whose external manifestation is an accelerated pulse. Hence therefore we can readily understand both how in the six first operations, (where the individual undergoing the process required one hour and a half longer than he of the five last experiments, to produce the same effect, viz., three quarters of an hour's sweating), we can understand how in these operations it should be discovered that after three hours, that is just a quarter of an hour before the commencement of the sweating the pulse should begin to increase in rapidity, as it does. It is just one beat quicker than it was when last examined. Hence also we can understand how in the last five experiments at the termination of two hours, that is, about a quarter of an hour after the commencement of perspiration, it should be

considerably more accelerated, than when last examined. And we accordingly find that it has gained since that occasion 6.2 beats in the minute. Hence moreover we must necessarily comprehend how it happens, that in both series of operations equally the circulation should display still greater increase in rapidity at the termination of the packing. In the first series this elevation numbers 8.41 arterial pulsations, in the second just 4 in the minute.

The effect of the shallow-bath upon the pulse in the first series is—twice to depress it, twice to elevate it, and twice to leave it unaffected. It is therefore most consistent in its inconsistency. In the second series of experiments this bath diminishes the rapidity of the pulse once, and augments it four times. In both divisions the drying-sheet produces universally the same result, namely acceleration.

The temperature of the atmosphere surrounding the body, and within the blankets, is singularly uniform, more especially in reference to the first series of operations. In these six experiments with only one exception it was unvaried. The thermometer always stood at 102° F. And in the case of the exception there was only half a degree of variation, the temperature being on that occasion 101.5° F. In the second series it is not quite so constant. It first stood at 99° F., then at 101° F., and then three times at 100° F. The thermometer ranged therefore between the two extremes, 99° F. and 102° F. Now the natural temperature of the blood is 98° F. That therefore generated by the blanket-packing is always slightly higher than blood heat. Having now summed up all the particulars concerning the pulse at different stages of the process, the temperature of the operation, &c., it will be fit to describe the *modus operandi* of the blanket-packing, and to draw a comparison between it and sundry other sudorific baths, as the hot air and vapor.

When a person is closely packed in six blankets, one at

a time, adjusted so as to fit accurately about the throat and feet, it may be easily supposed that the envelope so formed is tolerably air-tight. This indeed is the pivot upon which the whole operation turns. If the individual be not well tucked in so as, if the author may be allowed the expression, to hermetically seal him up, all diaphoretic action is impossible. For some time then the patient so lies, simply air-tight, but without the production of any obvious effect. His pulse is unaffected (after of course the first great depression wrought by the influence of the recumbent position); he is neither particularly warm nor particularly cold; no sensations of either pleasant or unpleasant character have supervened. All this time however the process has been doing its work silently, but surely. The animal heat, that is being constantly disengaged from the skin, has been all this time being liberated from the cutaneous pores. Unable to penetrate the impervious blanket wrappings, it has of course remained stationary, enveloping the membrane from which it has been discharged. This natural disengagement of heat is comparatively a slow process. This stage of the operation therefore is certainly a slow one. But gradually now the patient begins to experience a slightly warm and moistish, or clammy sensation. This is owing to the relaxing influence of the accumulating heat upon the skin. Still as yet there is neither a flow of perspiration, nor is the pulse accelerated. At last however so much caloric has been eliminated from the surface of the body, that the temperature of its surrounding hermetically-sealed atmosphere surmounts that of the blood. It becomes more elevated than 98° F. Immediately a change is manifested. The temperature has now attained sufficient power to stimulate the organs of circulation. The heart increases in activity. The pulse therefore is accelerated, and the circulation every where rendered more vigorous. By this means of course blood is poured with greater profusion into the skin. That membrane is already relaxed with the previous heat. No sooner there-

fore do its dilated pores receive this augmented influx of fluid, than their gaping orifices discharge it freely. In this way the surrounding air, by the addition of this warm, cutaneous vapor, becomes still more elevated in temperature. The organs of circulation therefore are urged by a still greater stimulus. The perspiration still more increases. The patient soon feels wet. Large bead-like drops are observed upon the forehead. And so the operation goes on, till it is thought expedient to bring it to a termination. The patient is then put into a shallow-bath for the sake of constringing the relaxed skin, and shutting up the open mouths of the perspiration-pores, in order that the latter may not continue to exude moisture; as they otherwise would, for an indefinite time. For were the skin suffered to remain in the tender, soft, and relaxed state, in which it leaves the blankets, and were the perspiration allowed to continue draining from it for an indefinite period without attempt at checking it, the patient would be rendered extremely liable to take cold, and moreover great exhaustion and debility would probably follow. It may be distinctly laid down as an almost universal law, that every hot bath, that is general sudorific bath, applied to the whole surface of the body, should be followed by a cold ablution. By cold the author does not mean to convey, that the water must be necessarily of the natural temperature. He means cold in comparison with the heated atmosphere from which the patient has just emerged. Cases occur where it is not expedient to administer a perfectly cold bath after a hot one. Under these circumstances water of a temperature of 60°, 65°, or even 70° F. would be cold by contrast to the preceding hot application.

The effect of the immersion of the body in the shallow bath, in raising its temperature, need not be discussed here, as the same subject is fully treated in the chapter appropriated to the shallow bath.

In the first series of operations the amount of weight

lost by the process of sweating is as follows, for each experiment, commencing with the first: $12\frac{3}{4}$ oz., 1 lb. $3\frac{1}{2}$ oz., 6 oz., 1 lb. 2 oz., 12 oz., $12\frac{3}{4}$ oz. The average quantity therefore for each operation would be $13\frac{1}{2}$ oz. The reason that the same person at one time loses in weight nineteen ounces and a half, and at another time only six ounces, (not so much as one-third of that quantity,) the author is not yet in a condition to explain. In the second series of operations the numbers representing the loss of weight, beginning with the first experiment, are these: 9 oz., $8\frac{1}{4}$ oz., $6\frac{1}{2}$ oz., $7\frac{3}{4}$ oz., and 7 oz. Here an average is obtained of only $7\frac{3}{4}$ oz., which is seen to be a quantity much inferior to that of the first series of packings. From a comparison of these two results a general average of $10\frac{1}{2}$ oz. may be deduced. This then may be considered about the ordinary amount a person loses in substance by lying in the blankets about the usual length of time. And the blanket packing may be considered essentially a sudorific apparatus.

From this marked sudorific property, it might be with reason supposed, and indeed very generally is supposed, that the blanket was a reducing agent *per se*. This however is quite a mistake, as proved by these experiments. If the reader will refer to operation the seventh, he will perceive that the individual there weighed at the commencement of the process, and at the commencement of his series of packings, 7 st. 13 lbs. $8\frac{1}{2}$ oz. By now directing his eye to the termination of the eleventh experiment, he will find that he has actually increased in weight, after a daily packing for five days, for he now weighs 8 st. 0 lb. $13\frac{1}{4}$ oz. Diverting his attention thence to the first series of operations, the reader will see that the bather weighed more at the commencement of the second process than at the commencement of the first—that he weighed more at the commencement of the fourth than at the commencement of the third—and that in the interval between the termination of the fifth operation and the termination of the first, that is,

after a daily packing for four consecutive days, the individual only lost ten ounces and a half in substance, although at *each operation* he lost in weight on the average considerably more than that amount, namely, thirteen ounces and a half. In fact his having diminished in bulk by four packings even that ten ounces and a half the author ascribes entirely to some contingent casualty.

In operation the sixth will be observed a sudden and remarkable diminution of weight, somewhat startling at first, but not at all puzzling when it is known that a substantial article of apparel was on that day abandoned.

From these experiments it follows that, cæteris paribus, the blanket packing, although for the time being it abstracts considerably from the weight of the body, is certainly *not* a reducing process. This fact may be explained on the strictest physiological grounds with perfect facility. In the first place, as proved by the accelerated pulse, it invigorates the whole circulation. This promotes those chemical changes before described as constantly occurring in the various tissues, and whose additional energy ensures the more rapid withdrawal and absorption into the blood of worn-out, effete matters, and necessitates their speedy excretion from the body. The increased activity of these chemical decompositions, the augmented flow of blood into the skin, and the very pervious state of that membrane produced by the relaxing influence of heat, these three circumstances together cause, as before seen, an abundant secretion of watery fluid. But this material being so abruptly and rudely withdrawn, there is immediately felt in the system a vacuum, a want, a desire for new material to fill the place of what has been abstracted. Thus is generated an appetite. More food than usual is swallowed, and the person speedily regains his diminished substance. These same facts and arguments apply both to the vapor and hot air bath, as well as to the blanket packing. A gentleman took the vapor bath every day for a week. Each time he remained in it

half an hour. The following are the results in reference to his weight.

	Weight prior to the bath.			Weight after the bath.		
	St.	lbs.	oz.	St.	lbs.	oz.
1.	10	10	12	10	9	8
2.	10	11	5	10	10	5
3.	10	11	5	10	10	15
4.	10	12	3	10	11	4
5.	11	11	15	10	11	0
6.	10	11	10	10	10	12
7.	10	12	15½	10	12	7½

By a simple calculation it will be perceived that this gentleman had withdrawn from his body by the influence of the warm vapor six pounds, within two ounces, of substance. *Nevertheless at the termination of the whole seven sweatings he weighed nearly two pounds* MORE *than he did before the commencement of the operations!* Another fact too may be interesting to many; while submitting to this sudorific ordeal, and increasing in bulk thereby, his diet was exclusively confined to articles of *vegetable* growth. Nothing animal was taken, if we except some roast-meat gravy, which was permitted as a relish to his greens and potatoes.

Another gentleman took the vapor bath four times in five days, that is omitting one day, and each bath lasting half an hour, with similar results, as shewn in the ensuing table.

	Weight prior to the bath.			Weight after the bath.		
	St.	lbs.	oz.	St.	lbs.	oz.
1.	8	1	12	8	1	3
2.	8	1	2	8	0	13
3.	8	1	6	8	0	15
4.	8	1	10	8	1	3

It will be at once seen here that the person after the fourth bath weighed precisely the same as after the first, although the vapor had extracted in the meanwhile a pound

and a half of substance. This person at the time of the operations employed both animal and vegetable diet. The same gentleman took three hot air baths on consecutive days, each operation lasting forty minutes. The heat was generated by a spirit lamp placed beneath a common chair, and confined to the periphery of the body by the wrappings of half a dozen blankets. Before the commencement of the series he weighed 8 st. 2 lbs. 15 oz. At the termination of them, just *after* the last sweating, his weight was 8 st. 3 lbs. 4 oz.!

From all these experiments then it follows, as an indubitable fact, that no sudorific process, neither the blanket packing, the vapor bath, nor the hot air apparatus, is capable *per se* of diminishing permanently a person's weight. In other words, *they are* NOT *reducing agents.** If it be desired to employ any of these three baths to diminish a person's bulk, they must not be used alone. Limitation in diet must be subjoined; otherwise, if the appetite be permitted to satisfy itself, as before, no diminution of weight will follow their employment. It may be as well to add that the mode of reducing a person is not by their means at all. There are other far speedier, safer, and more certain hydropathic measures capable of effecting this object when requisite. But as this work is intended to be one of research merely, the results of such experimental inquiry alone are treated. It would be out of place therefore to pursue the theme further into the correct and only method of ensuring reducion.

The reader will probably remember that the blanket packing always augments the frequency of the pulse. Indeed, as the author has endeavoured to explain, this is necessary previously to the production of perspiration. He does not of course mean to assert that the pulse, even when so stimulated, must attain the rapidity with which it moved before the commencement of the process. But as the latter

* Unless the patient's vital powers be extremely feeble.

rate of speed was perfectly natural, under the influence of the various exciting circumstances then existing, the active exercise preceding the bath, the hurry of quickly undressing, and the accompanying nervous excitement, so, when gradually this animation of nervous, muscular, and visceral systems is gradually allayed, and perfect quietude, both mental and corporeal, and the recumbent position are established, it is just as natural for the pulse to have fallen twenty or thirty beats, and to continue to beat with that comparatively slow movement. Take for an example the very first operation. Wrought upon by various rousing influences, it naturally enough beats at the commencement of the process ninety-two strokes in the minute. At the expiration of an hour all these exciting causes have disappeared, and moreover the influence of the horizontal position is felt. We now see the pulse temperately moving sixty times in the same period. It has subsided thirty-two degrees. But under the present circumstances the present state of things is the natural state. So long, therefore, as the patient remains quiet, both in muscle and mind, his envelopes and posture unaltered, anything that produces an acceleration of his pulse must be what is technically called a stimulant, an artificial stimulant. And we have seen that after a time the blanket packing itself does this. Ergo the blanket packing is a stimulant. And beyond a doubt it is a most decided stimulant. Now medical science has proved that in certain diseases the employment of stimulants is beneficial, and in certain others their employment is deleterious. The class of cases, in which stimulants, that is, remedies that accelerate the pulse, are bad, is that class where the pulse is already accelerated. This class of cases embraces febrile and inflammatory disorders. It follows therefore from this reasoning that the blanket packing, which is a decided stimulant, is inadmissible in all complaints associated with either inflammation or febrile excitement. And here, indeed, principle and practice, theory and

fact support each other. For daily experience demonstrates the soundness of the argument. It is not an uncommon notion among the laity, that the best cure for a cold in the head or chest, or for an acute attack of the gout, or for awkward head symptoms arising from plethora of the brain, &c., is to give the patient a good sweating in the blankets. The reader is now prepared to understand how such gross treatment will in all probability exaggerate the cold, convert the gouty pain to anguish, and quench mere awkward symptoms in apoplectic stupor. Let it therefore be considered a general rule that in diseases attended with a quickened pulse, or other evidences of febrile excitement, the blanket packing is to be avoided. In all such cases, indeed, the hydropathic sheet anchor, the great hydropathic antiphlogistic, the hydropathic *calomel and opium, antimony and bleeding* is the wet sheet.

It is not improbable it may have occurred to the reader that the author was guilty of forgetfulness in not hitherto saying a word concerning the influence exercised by the blanket packing upon the respiration. He has, however, purposely omitted to do so, till he should have a fit opportunity for drawing a comparison between the effects of the blanket packing and the hot air and vapor baths. He has now that opportunity, and will therefore proceed to discuss this influence upon the pulmonary system.

It will be seen at once that under the influence of the operations the respiration is less regular and consistent than the pulse. Nevertheless in some matters it is sufficiently steady for the establishment of a few general rules of great importance. In the first place with one exception, namely in the ninth experiment, it always is less frequent at the expiration of an hour than before the commencement of the process. In the next place as a general rule it falls in this period by comparison considerably less than the pulse. Let the reader, after having proved this statement satisfactorily to his mind by examining carefully

the details of the experiments, now consider the advantages arising from this superiority displayed by the respiration. Let him call to mind what has been said on this subject in every preceding chapter. In the third place it will be noticed that as a general rule the rapidity of breathing increased in the same ratio with the augmented speed of the arteries. It will quite repay the inquiring reader's curiosity, and therefore the author's trouble in arranging it, if the former will carefully study the following table. The figures in the second and third columns represent the respective condition of the pulse and respiration for all the eleven operations at the termination of the process, that is when the sudorific action is in full play.

Operation.	Pulse, per minute.	Respiration, per minute.
1	70	18
2	60	17
3	60	18
4	66	17
5	68	24
6	64	18
7	80	20
8	72	20
9	76	32
10	92	30
11	72	30
	11)—780	11)—244
	70.90	22.18

The quotients resulting from these sums represent the average speed of the pulse and respiration during the most energetic period of the sweating process. Now the normal relation of the movements of the heart and lungs, that is of circulation and respiration is, (as the author has proved by exact personal experiments, detailed in the

chapter on the shallow bath,) as 72.73 of the former to 19.31 of the latter, or as 3.76 to 1. But by a simple rule of three 22.18 : 70.90 : : 1 : 3.19. So that in the preceding table the pulse is slower than this average number by .83 beats in the minute, for 72.73—1.83=70.90. At the same time the respiratory movements are more frequent than this average by 2.87, for 19.31+2.87=22.18. This comparatively slow and steady action of the arterial system, and the unequivocal acceleration of the breathing process must be carefully stored up in the reader's mind, for, as will immediately be explained, they are of the greatest moment.

It not unfrequently happens that patients of a susceptible disposition become so nervous, so extremely although unaccountably nervous in the blanket-packing, that that process is absolutely inadmissible again. It is then requisite to search for a bath capable of exerting a similar physiological effect, but free from its lengthy tedium. Such an apparatus we luckily possess in the hot air and vapor bath. And these may often be employed as very good substitutes for the former. But they unfortunately possess many most serious disadvantages. In the first place there is no means of accurately regulating their temperature. It is sometimes too hot, sometimes too cold. Very frequently indeed it grows hot too suddenly. With regard to the vapor bath the latter is nearly always the case, for it is necessary to have a considerable amount of hot vapor in the apparatus before the patient steps into it. Otherwise the temperature is too long in rising, the patient in the interim sitting in the cold. Entering with the exposed skin suddenly into a heated atmosphere of course is bad. The author's rule is, that all his patients should go into it at a temperature of 80° F. It is then gradually raised to the requisite elevation. Then again some persons *like,* or *can stand,* as they say, a high temperature, as 115° F. or even higher by a thermometer placed at the top of the ap-

paratus. Others feel suffocated at a comparatively low one, as 90° or 95° F. Now those things, which patients like best, do not always agree with them best. But in the blanket-packing we leave all this to nature. We do not trouble our heads about it,—and with the happiest results. She gradually warms the surface in the very gentlest conceivable manner, preparing the skin for the rush of perspiration, which is to occur when, and not before, all parts concerned in that operation are ready. By imperceptible degrees she raises the temperature of the atmosphere surrounding the body, till it reaches that of the interior of the body. There is no rude shock of heat, as in the case of the vapor bath, and, to a less extent, of the hot air one too. The process goes on, and slowly the temperature outside the skin passes that of the blood—rises beyond 98°. And now the influence of this elevation begins to be felt by the arterial system. The pulse becomes accelerated —not suddenly—it does not leap up twenty or thirty beats in a few minutes as in the vapor bath—but slowly and cautiously, a single beat perhaps for every five minutes. At last, when all is in order, the skin prepared for the coming discharge, the patient ready and expecting it, &c. &c., the perspiration flows forth.

Besides this matter of temperature, regulated in the one instance by undeviating physiological laws, and in the other instances at the mercy of a capricious patient, or a careless attendant,—there are other points in which the blanket-packing is immeasurably superior to the employment of hot air and vapor. The author himself took a series of both vapor and hot air baths to ascertain their physiological effects. On one occasion when enveloped in vapor, the thermometer placed at the top of the apparatus indicating a temperature of 107°, he found his pulse galloping along at 150 per minute, while his respiration was toiling at the ordinary pace of 19.

It may be as well at once to mention another fallacy in

reference to the vapor bath. The same gentleman has found that sometimes when at the ceiling of the apartment the mercury stood at 103°, at the floor it was *twenty-seven* degrees higher. Incredible as this discrepancy may appear, it is true, and the truth was ascertained by repeated experiments, that the temperature of the bath was at the same time 103° and 130°. And this he thinks may be established as a general rule, namely, that on that plane in which the steam makes its entrance, and which is generally at, or near the bottom of the bath, the thermometer rises many degrees above that near the ceiling of the apartment. All this *par parenthese*.

On another occasion the pulse was 88 before entering the bath, and the respiration 18. After he had been in the bath a few minutes, the thermometer in the same position standing at 102 the pulse had risen to 128, that is *forty* beats more in the minute than before, while the respiration was stationary, absolutely stationary! So that the same number of respiratory movements, (which is equivalent to saying the same amount of air, or oxygen inhaled,) had now to purify as much blood as would be pumped into the lungs by a hundred and twenty-eight beats of the heart per minute, that had been before devoted to the purification of as much as would be impelled thereinto by only eighty-eight strokes of that organ. Therefore, as much blood as the lungs would receive from the forty additional pulsations of the heart must pass on through the pulmonary tissue laden with its previous impurities, and in this polluted state be distributed to every part of the body, *for the purpose of imparting nourishment, vigor, life!* On a third occasion, and this time it was the hot air bath that was employed, the author counted 120 pulsations at his wrist, while his chest rose and fell but *fourteen times*! It is needless multiplying examples. No series of experiments on this subject are here detailed, no tabular views arranged. For in the first place the few examples enu-

merated are sufficient to illustrate the argument. And in the second place this little work has already swollen in bulk beyond the limits of the original intention. It will be quite enough then to state in general terms, that one deleterious effect, following the use of the hot air and the vapor baths, is the great, sudden, or violent impetus given to the heart and arteries, unaccompanied by any corresponding augmentation in the purifying process of respiration. Consequent upon this fundamentally wrong state of things comes a long procession of evils. Hence follow fainting, giddiness, congestion of the brain, visible injection and smarting pain in the eyes, nausea and vomiting, feelings of suffocation, distressing palpitation, and an endless train of miseries. The author has himself suffered in his personal experiments from most of these ugly symptoms, especially from the painful affection of the conjunctivæ, the nausea, faintness, and palpitation. During one experiment his heart beat so violently that he was compelled to postpone the subsequent cold plunge for several minutes. Now, reader, recall to your memory the very different condition of the system under the influence of the blanket-packing—no violently palpitating heart audibly battering against the chest there, but a pulse steadily and quietly moving at 70 per minute—no undecarbonized, contaminated blood carrying its poisonous influence into every tissue, for it was shewn that in that process the respiration was to the pulse as 22.18 is to 70.90, but on the contrary a quality of blood even more unsullied, more pure than before the operation—no indefinite fluctuating temperature depending upon the caprice of nervous people, and human carelessness, but a thermometric state invented by nature as most fit for the purpose, and carried out by her in the most efficient and unvacillating manner.

Before the author concludes this chapter let him warn the reader, that although under all circumstances, where the employment of the blanket-packing is practicable, that

bath is pre-eminently superior both to the hot air bath, and the vapor bath, nevertheless he admits that cases do occur, where these two operations are not only admissible, but capable of doing eminent service.

CHAPTER V.

THE SHALLOW BATH.

WITH this bath experiments were made on the pulse, respiration, and temperature of the water.

A young man, twenty years old, weighing eight stones, and of an excitable temperament, received the first series of operations with the following results :—

FIRST SERIES OF OPERATIONS.

Each bath lasting one minute and a half.

	Pulse before bath.	Pulse after bath.	Resp. before bath.	Resp. after bath.
1.	108	120		
2.	100	108	24	28
3.	116	120	24	40
4.	116	122	30	36
5.	108	108	24	32
6.	96	96	30	36
7.	88	104	24	32
(The next five followed the dry-packing.)				
8.	80	88		
9.	72	84	20	28
10.	76	80		
11.	92	88	30	26
12.	72	96	30	36
(The next six followed the wet-packing.)				
13.	53	84	22	21
14.	64	76		
15.	60	72	22	24
16.	60	64	19	24
17.	58	96	18	26
18.	60	74	19	26

Out of the above eighteen operations it will be perceived that the pulse was *fifteen times* accelerated by the bath, *once* retarded, and *twice* uninfluenced. By adding together the figures in each column, and dividing the results by 18, the average estimates will be obtained. In this way it will be found that the average pulse was 82.16 before the operation, whereas that after it was 93.33. Here therefore is exhibited an elevation of 11.17 beats in the minute, for 93.33—11.17=82.16.

In respect to the respiration, the reader will observe several vacancies. These were unavoidable, from the fact of the author being suddenly summoned away, and other contingent circumstances. Nevertheless, the effect of the bath upon the lungs has been examined fourteen times. And out of those fourteen times the respiratory movements have declined in frequency twice, and been increased twelve times. The averages, ascertained by adding together the figures in each column respectively and dividing the sums by fourteen, will give 24 as that of the respiratory movements before the bath, and 29.64 as that after the bath, shewing an increase of 5.64 in the minute, for 29.64—5.64=24.

It being then demonstrated that in this series of operations there is all but unexceptional acceleration both of pulse and breathing, the next and most interesting point to be investigated is this, whether *in proportion to each other* the pulse has been elevated beyond the breathing, or the breathing beyond the pulse. To effect this desirable object in the most accurate manner, it will be necessary to compare the results of the calculations of the respiration, not with the general results of the calculations of the pulse, as just described, but with those fourteen numbers (having reference to the pulse) only, which correspond with those having reference to the breathing. The difference thereby manifested will be slight, but in experiments of this kind accuracy should be the *summum bonum*.

By making these calculations, namely, by adding together the fourteen numbers, both those applying to the pulse before the bath, and those after it, and dividing each total respectively by 14, it will be seen that the average rapidity of the pulse before the process was 82.21 beats per minute, instead of 82.16, (which was the general result of all the experiments,) and after the bath 94 beats instead of 93.33, (which was also the general result of all the experiments). And 94—82.21=11.79. The latter figures therefore denote the average elevation of the pulse, instead of 11.17.

It has now been shown that while the respiration rose by 5.64 beats per minute, the pulse rose by 11.79. Now 5.64 : 11.79 :: 1 : 2.09. So that for every single additional respiration the pulse increased two beats and nine hundredths. This was the relation they bore to each other, 1 to 2.09. Let us now see what is the usual corresponding ratio between them.

To elucidate this matter correctly, the author had recourse to his own pulse and breathing, as being the most convenient for the experiment, and for whose healthy performance he could vouch. By instituting a frequent comparison between these two functions during various periods of the day and under diversified circumstances, and such as would be likely to modify the results, (as, for example, before and after meals, before and after taking exercise, in the sitting, standing, or recumbent posture, &c., &c.,) he found the most remarkable fluctuation—so much so that it was clear no one experiment would be sufficient to elicit the truth. Such being the case, it was thought expedient to investigate the state of the pulse and respiration during *all* periods of the day, and under *all* the most varied circumstances. When this should be done a sufficient number of times, a comparative analysis of the whole should be made, and a probably correct average would be obtained. This was therefore done, and the following table soon drawn up.

The first column indicates the hour of the day the experiments were performed—the second row the pulse—the third the respiration. It would be as well, however, to mention, that more experiments were made than are now presented to the reader. They are omitted here for the sake of brevity and conciseness, and without interfering with the results. For example, if it were found at 11 o'clock a.m. on one day that the beats of the pulse were 67, and of the respiration 16, on another day that the former were 68, and the latter 17, and on a third day that the former were 69, and the latter 18, these figures would be curtailed into the intermediate and average numbers 68 and 17.

Time of day.	Pulse.	Respiration.	
A. M.			
7	64	14	before rising.
7 30	61	14.5	
7 45	62.4	17.8	before walking.
8	80.8	38.4	after walking briskly.
8 30	86	20	after breakfasting at 8.
8 45	84	17	
9 30	93	26	while out walking at a moderate pace.
10	88	24.5	
10 45	68	14.5	sitting quietly in his study.
11	68	17	
P. M.			
1	66	15.5	dining at half-past 1.
1 20	60	15.5	
2 15	72	18	
2 45	70	15.5	
5	88	30	while out walking at a moderate pace.
6	63	17	sitting quietly in his study. Tea was taken at 7 p.m.
8	71	16.5	
11	64	16	

At this point it was considered that a sufficient number of experiments had been performed to warrant a confident reliance on the event, as being as near as possible to the truth; and more especially so as it was found now, that on adding together the figures in the second column, and dividing the sum by 18 the result, which will denote the average rapidity of the pulse, was found to be 72.73. This number, *minus* the fractional figures, is actually the one, that by universal consent represents the standard pulse of health. This being the case it becomes *a priori* most reasonable to consider the average rate of the respiratory movements, whatever it may be, that shall follow on an analysis of the same experiments, which yielded the standard pulse, to be the *standard* respiration.

If the third column of figures be added together and divided by 18, the average and, we may now add, standard rapidity of respiration will be indicated by the result. This result is 19.31. The correct rapidity of the respiration therefore bears the same relation to that of the pulse as 19.31 does to 72.73. And as 72.73 : 19.31 : : 3.76 : 1. Therefore for every respiration there should be, to preserve their due equilibrium, 3.76 or nearly four beats of the pulse; or *vice versa*, for four beats of the pulse there should be a little more than one respiration.

Let us now return to the subject of the shallow-bath operations, which gave rise to these calculations concerning the equilibrium of the pulse and respiration. It will be remembered, that in those operations the average rapidity of the pulse (as gained by calculations from those experiments only which also contained an account of the respiration) was before the process 82.21, and after the process 94 in the minute, that the breathing motion took place 24 times per minute before, and 29.64 times after the operation. But in the first place, according to the analysis which has been made on the correct relation between pulse and breathing, or heart and lungs, 24 (standing for the res-

piration) will be too high for 82.21 (as the numerical representative of the pulse.) For as 72.73 : 19.31 : : 82.21 : 21.82. There is a balance therefore of 2.18 in favour of the respiration. In the second place 29.64 will also be too high a rate of speed of the lungs for 94 beats of the pulse at the termination of the process, for as 72.73 : 19.31 : : 94 : 24.95. Again therefore there is a balance in favour of the respiration, but this time to the amount of 4.69. So that it manifests not only an increase of rapidity, but an *increased increase* of rapidity. As the earth has two motions, one round the sun, and the other on its own axis, so the respiration has been accelerated not only *with* the acceleration of pulse, but *in proportion* to the acceleration of pulse. Under other circumstances the original respiration before the process having been 24, that is 21.82+2.18, that subsequent to the process should be 27.13, that is 24.95+2.18. But its actual rate of speed being marked by an additional 2.51, viz. by 29.64 its augmented rapidity is as it were two-fold. And from what has been already said on this subject in all the preceding chapters the sanitary effect of this is most evident.

Besides the effect of the shallow-bath on the pulse and respiration it was considered a point of great interest to discover the amount of heat abstracted from the body, and communicated to the water. The author therefore endeavoured to throw some light upon this subject by means of the following experiments, duly providing of course that the quantity of water should always be the same, namely, 15 gallons, and that the duration of the bath should be the same, namely one minute and a half. These experiments were conducted during some of the operations that were last described.

TEMPERATURE OF THE WATER.

	Before immersion.	After immersion.
1	...... 65.00 deg. F.	...... 66.00 deg. F.
2	...... 42.50 ,,	...... 45.00 ,,
3	...... 41.00 ,,	...... 42.50 ,,
4	...... 39.75 ,,	...... 41.30 ,,
5	...... 39.50 ,,	...... 41.50 ,,
6	...... 42.00 ,,	...... 44.00 ,,
7	...... 51.00 ,,	...... 52.00 ,,
8	...... 53.00 ,,	...... 54.00 ,,
9	...... 53.00 ,,	...... 55.50 ,,
10	...... 55.00 ,,	...... 56.00 ,,
11	...... 53.00 ,,	...... 54.00 ,,
12	...... 60.75 ,,	...... 61.75 ,,
13	...... 48.50 ,,	...... 49.25 ,,
14	...... 52.00 ,,	...... 52.75 ,,
15	...... 48.00 ,,	...... 49.33 ,,
16	...... 49.25 ,,	...... 50.00 ,,
Total	16)—793.25° F.	16)—814.88° F.
Average	49.57° F.	Average 50.93° F.

Having, as above, ascertained the average temperature of the water of the shallow-bath both before and after the process, it is easy to calculate the average elevation of temperature caused by contact with the body. 50.93—49.57=1.36, which may be taken therefore in this individual as the representative of the amount of caloric abstracted from his system at each operation. More will be said on this subject in another place.

The second series of shallow-bath operations were performed by a man twenty-eight years old, weighing ten stones and a half, and of a decidedly phlegmatic, unimpressionable diathesis. The results guided by the peculiarity of temperament will be seen to differ in an important manner from the first series. They are as follows :—

SECOND SERIES OF OPERATIONS.

Each bath lasting one minute and a half.

	Pulse before bath.	Pulse after bath.	Resp. before bath.	Resp. after bath.
1	72	72		
2	86	68		
3	80	72		
4	84	68		
5	76	68		
6	76	60		
7	96	84		
8	84	78	20	22
9	84	72	22	30
10	100	72	24	30
11	88	84	22	28
12	96	72	24	28
(The next six followed the dry-packing.)				
13	70	60		
14	60	60	17	17
15	60	60	18	18
16	66	60	17	21
17	64	72	18	22
18	72	72	22	24
(The next three followed the wet-packing.)				
19	46	72	26	26
20	44	56	20	28
21	44	60	26	26

Totally opposed to the results of the first series of the shallow-bath operations, in the present series there is exhibited with certain exceptions a decided depression of the activity of the pulse. At the same time the speed of the respiratory movements does not merely remain unimpaired, but is actually considerably augmented. In reference to the pulse the exceptions just mentioned are three-fold.

Firstly, in operations 1, 14, 15 and 18, the pulse continues unchanged. Secondly, in No. 17 there is an elevation of pulse. Now both these exceptions are clearly referrible to casualty. But the third exception is of so important and interesting a nature as to demand a further consideration. It occurs in operations 19, 20, and 21, in each of which there is an extensive acceleration manifested. At the very first view the uniformity and largeness of the augmentation clearly demonstrate something more than mere chance at the root of the difference. And immediately that we investigate the matter, the *a priori* view is justified.

Glancing his eye at those of the figures alluded to, which indicate the state of the pulse before the bath, the reader's attention will be at once struck at their extreme lowness. He will probably have thought that the human pulse could never reach so low a point as 44 without extinguishing life—a supposition which, extremely natural as it was before, is now demonstrated to be incorrect. The next question then to be considered is, could such a pulse be natural, or compatible with perfect health? Certainly not. It is a highly artificial state produced by artificial means, namely, the wet-sheet. But this question is of course fully discussed in the chapter devoted to that process. The only matter now to be discussed is concerning the uniform elevation of the pulse after leaving the wet-sheet, and taking the shallow-bath, in an individual whose pulse is lowered by the shallow-bath under other circumstances, that is when unpreceded by the wet-sheet. The cause of this elevation, after what has now been said about the extreme lowness of the pulse in these three cases, must be apparent. It is already as slow as it can be, consistently with the due discharge of the corporeal functions. Any further retardation therefore might be attended with detrimental effects. So that being incapable of falling it must either rise or remain stationary. Now the present rate of speed being highly artificial and

unnatural, the result both to be expected and desired, is that it should rise, and assume more or less nearly its pristine rapidity. And this actually takes place, and an admirable provision of nature it is.

The reason therefore for the third exception to the general rule (that of depression of the pulse in this series of operations, which are influenced no doubt by the temperament of the individual,) is so definite, and all-important, that in summing up as usual the averages of rapidity the author will not include the three last numbers appertaining to the pulse. And as there may be some although unknown influence exerted by this arterial peculiarity upon the lungs, the accounts of the respiration corresponding to them will also be omitted.

Before the author proceeds to figures, let him beg to remind the reader that the above operations were performed on a person in health, and that the above statements refer only to persons in health. Of course if the wet-sheet were prescribed to an invalid for the sake of reducing the pulse, as for example in an inflammatory disease, means would be taken to prevent a subsequent return to its former height, till the inflammation should be subdued. Such means are ready to the hand of every hydropathist.

To arrive at a knowledge of the average rapidity of the pulse both before and after the process in the second series of operations, let the calculations be made in the usual way by adding together the first eighteen sets of figures in the two first columns respectively, and dividing each result by 18. On doing so it will be found that the first column amounts to 1414, and $1414 \div 18 = 78.55$, which therefore represents the average rapidity of the pulse before the bath. The second column yields a total of 1254, and $1254 \div 18 = 69.66$, which accordingly describes the state of the pulse after the bath. Now $78.55 - 69.66 = 8.89$. The pulse therefore sinks on an average 8.89 beats in the minute at every bath.

The calculations for the respiration must be made by adding together separately the first ten numbers of the last two columns and dividing by 10. The third column will be seen to give 204 by addition, and $204 \div 10=20.40$. The fourth column amounts to 240, and $240 \div 10=24.00$. These two results therefore represent the average rapidity of breathing, the first before, the last after, the operation. $24.00—20.40-3.60$, so that while the pulse was lowered 8.89 degrees, the respiration increased by 3.60.

To discover the amount of heat communicated to the water by his body the following experiments were performed with this individual, most of which were accomplished during the operations that have just been detailed. The thermometer was allowed to remain in the water for a little while before the mercury was examined, to render the results as accurate as possible.

TEMPERATURE OF THE WATER.

	Before immersion.		After immersion.	
1	46.00	deg. F.	48.50	deg. F.
2	42.50	,, ...	45.00	,,
3	43.50	,, ...	46.00	,,
4	43.00	,, ...	45.00	,,
5	43.00	,, ...	44.00	,,
6	43.00	,, ...	45.00	,,
7	42.00	,, ...	44.50	,,
8	41.50	,, ...	43.00	,,
9	43.50	,, ...	46.00	,,
10	39.75	,, ...	42.25	,,
11	39.50	,, ...	41.50	,,
12	42.00	,, ...	44.50	,,
13	43.00	,, ...	45.00	,,
14	42.50	,, ...	44.00	,,
15	42.50	,, ...	43.75	,,
16	42.00	,, ...	44.00	,,
17	49.75	,, ...	52.50	,,

	Before immersion.		After immersion.	
18	...... 47.00	,,	...... 49.00	,,
19	...... 50.75	,,	...... 52.75	,,
20	...... 52.50	,,	...... 54.50	,,
21	...... 53.75	,,	...... 55.00	,,
22	...... 54.75	,,	...... 56.00	,,
23	...... 57.50	,,	...... 58.50	,,
24	...... 47.50	,,	...... 49.00	,,
Total	24)—1092.75° F.		24)—1139.25° F.	
Average	45.53° F.		Average 47.46° F.	

The average temperature of the water both before and after the operation being ascertained as above it is easy to discover the relative elevation of the thermometer during each process. 47.46—45.53—1.93. This then is the average of twenty-four experiments. But it will be perceived that there is considerable irregularity in this matter, there sometimes being more than twice as much difference of temperature as at other times. The extremes will be found on letting the eye scan over the columns, to be one degree, and two and a half degrees of Fahrenheit's thermometer. Thus in experiments 1, 3, 9, 10 there will be seen two and a half degrees of difference between the two columns, whereas in No. 5 there is only one degree of difference. On this subject more will be spoken in the *analysis* of the shallow-bath operations.

The next and last series of operations with this bath were performed on the author of these pages. He thinks he may define his temperament as partaking of a mixed character, certainly not so excitable as he who underwent the first series, nor so phlegmatic as he who underwent the second. He proceeds to place them before the reader as follows :—

THIRD SERIES OF OPERATIONS.

Each bath lasting one minute and a half.

	Pulse before bath.	Pulse after bath.	Resp. before bath.	Resp. after bath.
1	72	72		
2	68	72		
3	70	84		
4	72	80		
5	80	74		
6	70	70		
7	80	64		
8	64	72		
9	70	80	14	24
10	70	84	16	24
11	72	84	18	24
12	72	84	16	28
13	76	72	18	24
14	80	76	18	22
15	80	96	18	28
16	68	72	17	24

Out of these sixteen experiments it will be perceived that the pulse fell four times, was stationary twice, and became augmented the remaining ten times. Of the eight experiments on the respiration that function was accelerated on every occasion.

The reader will now perceive clearly the different effects of the shallow bath produced according to the different temperament or constitution of the individual. In the present series the pulse fell 4 times in 16, that is 1 in 4, the author's disposition being neither excitable nor phlegmatic. In the first series, the bather being of an excitable constitution, the pulse fell only once in 18 operations. In the second, where the person was of a decidedly phlegmatic mould, the pulse fell *habitually*.

Let the figures of the first column be added together,

and they will be found to amount to 1164, and this divided by the number of times the experiment was performed will give a result that shall indicate the average rapidity of the pulse *before* the process. 1164 ÷ 16 =72.75.

The second column treated in the same way will discover the average state of the pulse *after* the process. The total amount of the figures is 1236, and 1236 ÷ 16 = 77.25. And 77.25—72.75=4.50, which is the average elevation of the pulse in this series of operations, and which, in accordance with what has already been said about the temperature of the bather, will be recognised as a moderate rise, and on contrasting the results of this with the first and second series of operations, will be found to represent a due medium between the latter two. More will be said on this subject presently.

The first column of figures referring to the respiration yields a total of 135, and 135 ÷ 8=16.87, which represents the average number of respirations per minute before the bath. The last column amounts to 198, and 198 ÷ 8 = 24.75, which is the number of respiratory movements after the bath. Now 24.75—16.87=7.88. Such, then, is the average increase of breathing. But it will be seen, although in this series of operations the pulse fluctuated considerably, and yielded a total rise of only 4.50 beats, the respiration manifested an uniform ascent and displayed an average on the total of 7.88, which (according to some recently described statistical calculations, whereby it was shewn that one respiration corresponded to 3.76 beats of the pulse) is virtually equivalent to between 29 and 30 arterial pulsations, and would be sufficient to counterbalance such an augmentation.

With this person also were performed some experiments on the temperature of the water. They are here detailed.

TEMPERATURE OF THE WATER.

	Before immersion.	After immersion.
1	47.00 deg. F.	48.00 deg. F.
2	48.00 „	50.00 „
3	48.00 „	50.00 „
4	41.00 „	43.00 „
5	43.00 „	45.00 „
6	44.00 „	46.00 „
7	42.00 „	44.00 „
8	44.00 „	45.50 „
9	42.00 „	44.00 „
10	43.00 „	45.00 „
11	44.50 „	46.50 „
12	46.00 „	48.00 „
13	47.00 „	49.00 „
	13)579.50° F. total.	13)604.00° F. total.
	44.57° F. average.	46.46° F. average.

46.46—44.57=1.89. This, therefore, is the average thermometric rise for each bath. As, however, in the experiments on temperature previously detailed, so also in these there is considerable fluctuation in the individual processes. The greatest difference between the heat before immersion and that after it is two degrees on Fahrenheit's scale, and the smallest is one degree. For examples, see the first and second experiments.

Analysis of the Shallow-Bath Operations.

The general effect of the first series of operations upon the pulse was to accelerate it by 11.17 beats in the minute. That of the second series was to diminish its frequency by 8.89 beats in the minute. In the third the pulse was quickened three times, and retarded once, in every four. What is the cause of this difference? It has been most satisfactorily explained on the score of variety of temperament,

The pulse of the excitable temperament is excited, that of the phlegmatic one is depressed, that of the neither excitable nor phlegmatic one is neither wholly excited nor wholly depressed. But it is more frequently excited (namely, three times as often) than depressed. It may, therefore, be considered that, where temperament does not interfere either one way or the other, the more general effect of the shallow bath is to accelerate the pulse. *Its physiological action is that of a stimulant.*

In all three series of operations its influence upon the respiration is constant. It invariably promotes the rapidity of that function, not only actually, but also in proportion to the increased activity of the pulse. It consequently exercises that salutary effect in the purification of the blood, which has received so much and so well-merited attention throughout this book. By promoting the respiratory process, it increases the quantity of air, and therefore the quantity of oxygen taken into the lungs. This gas is admitted into the air cells in greater abundance, in proportion to the amount of blood admitted, than is usual. A larger quantity of air being thereby devoted to the decarbonization of the *same* quantity of blood, that fluid is aerated, is oxygenated much more efficiently than before. And from the improvement thus effected in the quality of the blood flows incredible benefit to the general health of the system. For a few detailed advantages, let the reader refer to the introductory chapter.

It will be observed that in the first series of operations the rate of speed of the pulse prior to the commencement of the process did not at all affect its accelerating influence. Whether the pulse had been previously excited by exercise, or had been retarded by the horizontal position in the blanket-packing, or had been still further lowered by the depressing action of the wet-sheet, it makes no difference in the fact of its receiving increased rapidity from the employment of the shallow-bath. And with regard to the respiration precisely the same thing occurs.

In the second series, where the general effect of the shallow-bath upon the pulse is lowering, the blanket-packing interferes with this result to a considerable extent, but the wet-sheet altogether subverts the rule. In the three experiments, where the process last mentioned preceded the shallow-bath, the pulse was thereby brought to so low a degree before immersion in the water, that it would not have been practicable without danger for it to fall still lower. Nay more, it would not have been unprejudicial to health for it to continue for any length of time as low as it then was. Consequently nature made an exception in this case to her general rule. Sooner than permit the probability of detriment occurring to the system, she altered her policy and allowed the pulse, not merely to remain stationary, that is undepressed, but even to ascend. The same rationale will explain the same thing, which appears in a modified degree to follow the blanket-packing.

In the three last experiments of the same series the respiration will be seen to be twice stationary and once raised. Now the reader might possibly imagine that it must be very odd that, after all that has been said about the harmonious relation between the circulation and the respiration, the latter in two instances does not ascend in accordance with the former, which rises about twenty beats in the minute. And yet the reason that the respiration is in these cases unaffected is most obvious. By drawing a comparison the reader will immediately perceive that the figures denoting the velocity of the breathing process are not only not low, but are even very high, both in proportion to the condition of the pulse before it is elevated, and also in proportion to its increased rapidity. 26 to denominate the activity of the respiratory process is far more than equivalent to 60, or 72 as denoting the state of the pulse after the shallow-bath in the two experiments. It was therefore of course quite unnecessary for the respiration to be accelerated under the circumstances.

It will be noticed that, for the simplicity of the subject, the author has been somewhat elaborate in his thermometric experiments upon this bath. But he conceives that in this matter he can produce reasons sufficient for his justification. He commenced his investigation into the change of temperature effected in the water by the immersed body with a two-fold object. One was the same, that actuated him equally in all his researches, namely to elicit *any fact*, that might rise to the surface, no matter as yet whether of vital interest, or comparatively unimportant, knowing as he does that the *establishment* of a simple, and at first to all appearance uninteresting fact, not unfrequently lays the foundation for the erection by and by of a stupendous superstructure. The second object he held in view, although neither, in his opinion, more definite, nor to the philosophically enquiring disposition more important in its nature, still was one, that in point of time concerned us more nearly. He thought he descried through the vista of hydropathic ignorance (and as yet our knowledge of the subject, as in the future by a retrospective glance we shall find it to be, is extremely limited) he thought he descried an easy method by means of the thermometer of testing the constitutional powers of an individual. The immense advantage of gaining such information by a simple contrivance need not be dwelt upon. It could not be exaggerated. He expected it would be demonstrated that the greater a person's vigor of constitution, the greater impression would be made upon the temperature of the water. For if the various animal functions be conducted in a tolerably healthy manner, as the most, or one of the most important of them all is the generation of heat, this product, if by any means it should be more than usually abstracted from the body, would be the more readily re-supplied. The author therefore founded his theory upon this. Let a man be placed in a shallow-bath. So much animal heat is transferred from his body to the water. Now if his con-

stitutional power be vigorous, fresh caloric is immediately generated—the body becomes as warm as it was before—and so more heat is transferred to the water. But if his vital powers be much impaired, the loss of heat sustained by contact with the water is not easily replaced. The body does *not* become so warm as before. More heat is *not* transferred to the water. And the temperature of this fluid therefore should not rise in the same proportion as in the first suppositious case. To obviate fallacy in the results of course it would be necessary to have corrective rules relating to the weight, and perhaps temperament of the individual. The existence or non-existence of febrile excitement, that is the presence of morbidly abundant heat of surface, must also be taken into account.

This object, although still in the distance, and still indistinct, nevertheless still arrests his attention, and one day he hopes to grasp it. But alas! he soon found that to arrive at the wished-for point, and confirm his surmises, a vast number of experiments would be necessary. And it was needful not only that the experiments should be manifold, but that they should be performed on many and all sorts of individuals. He knew therefore that his own unaided efforts would be valueless. But he hoped that they would not be unaided; on the contrary that they would form a nucleus for the developement of a number of others by philosophically enterprising hydropathists. Experiments of a novel nature, and in a new field always require an immense amount of thought for the designing, and an immense amount of patience and industry for the carrying-out. It is not always therefore, as it always ought to be, that actual experiment, scientific experimental research by rule and measure, occupies the first consideration of those who adopt any novel practice. For this reason the author thought he should commence the thermometric experiments upon the shallow-bath, not that unsupported they would possess interest, but that they would be of

great value, if they were the means of exciting others to do likewise. In this way, when the results of the labors of others, emulous in the race of knowledge, should be known, and comparative estimates made of the whole, great scientific truths would be established. And when once he determined to commence this series of investigations, he resolved of course that this commencement should be as complete as it was in his power to make it. Hence then the comparatively, but not unfitly elaborate tables presented to the reader. Nor would it have been sufficient, as some persons may suppose, to have described the averages only, the quotients of the sums, without the insertion of the details. For in such case the justly critical reader would ask, "What is this average? How do we know it is correct? Where are the figures to prove its accuracy? It is a mere statement." In private life we believe every man, till he is convicted of a lie. But in science and philosophy the author himself credits nothing but what is demonstrated. Especially in the establishment of a new doctrine, or new practice, proof, absolute proof is indispensable. He contents himself therefore with merely stating the following facts.

As the average result of many operations fifteen gallons of water were raised in temperature during the period of one minute and a half by the immersed body of a man of sanguine temperament from 49.57° F. to 50.93° F., by one of phlegmatic temperament from 45.53° F. to 47.46° F., by one whose temperament is neither the one nor the other from 44.57° F. to 46.46° F. The elevation in the first instance amounted to 1.36° F., in the second to 1.93° F., and in the third to 1.89° F. An average deduced from these three estimates would yield for every operation 1.72° F. About one degree and three quarters may therefore be considered to represent the usual elevation of temperature.

CHAPTER VI.

THE SITZ BATH.

The first series of operations were undergone by a man weighing about ten stones and a half, and about twenty eight years of age. In every experiment there were about four gallons of water employed.

FIRST SERIES OF OPERATIONS.

OPERATION I.

	Pulse.	Resp.	Temperature of the water.
Before the process	100	20	43.00 deg. F.
After 5 minutes...	72	20	45.00 ,,
After 10 minutes..	72	22	49.00 ,,
After 15 minutes..	72	20	50.00 ,,

OPERATION II.

	Pulse.	Resp.	Temperature of the water.
Before the process	86	19.5	43.00 deg. F.
After 5 minutes...	64	20	45.33 ,,
After 10 minutes..	64	20	50.75 ,,
After 15 minutes..	64	20	50.75 ,,

OPERATION III.

	Pulse.	Resp.	Temperature of the water.
Before the process	72	19	42.50 deg. F.
After 5 minutes...	57	21	45.75 ,,
After 10 minutes.	54	21	48.25 ,,
After 15 minutes.	56	20	50.50 ,,

OPERATION IV.

	Pulse.	Resp.	Temperature of the water.
Before the process	66	20	43.00 deg. F.
After 5 minutes...	64	20	48.00 ,,
After 10 minutes	60	20	49.50 ,,
After 15 minutes	60	19.5	51.33 ,,

OPERATION V.

	Pulse.	Resp.	Temperature of the water.
Before the process	72	18	42.50 deg. F.
After 5 minutes...	54	19	45.50 ,,
After 10 minutes	54	19.5	48.50 ,,
After 15 minutes	51.5 ...	20	50.00 ,,

OPERATION VI.

	Pulse.	Resp.	Temperature of the water.
Before the process	68	20	44.00 deg. F.
After 5 minutes...	52	19	48.75 ,,
After 10 minutes	54	17	51.00 ,,
After 15 minutes	51	18	52.00 ,,

The second series of operations, which here follow, all lasted for half an hour, and were performed on the same individual as the first.

SECOND SERIES OF OPERATIONS.

OPERATION I.

	Pulse.	Resp.	Temperature of the water.
Before the process	76	19	43.33 deg. F.
After 5 minutes...	64	20	47.33 ,,
After 10 minutes	56	18	49.75 ,,
After 15 minutes	55	18	50.50 ,,
After 30 minutes	52	18	53.33 ,,

OPERATION II.

	Pulse.	Resp.	Temperature of the water.
Before the process	72	20	42.50 deg. F.
After 5 minutes...	62	20	46.00 ,,
After 10 minutes	56	20	48.50 ,,
After 15 minutes	52	20	51.50 ,,
After 30 minutes	46	18	53.25 ,,

OPERATION III.

	Pulse.	Resp.	Temperature of the water.
Before the process	71	19	42.00 deg. F.
After 5 minutes...	52	20	46.50 ,,
After 10 minutes	47	16	46.50 ,,
After 15 minutes	47	18	49.00 ,,
After 30 minutes	42	18	54.00 ,,

The third series were performed by the author upon himself.

THIRD SERIES OF OPERATIONS.

Each of fifteen minutes' duration.

OPERATION I.

	Pulse.	Resp.	Temperature of the water.
Before the process	72	18	49.50 deg. F.
After 5 minutes...	60	16	53.50 ,,
After 10 minutes	56	19	54.00 ,,
After 15 minutes	57	19	54.00 ,,

OPERATION II.

	Pulse.	Resp.	Temperature of the water.
Before the process	59	17	49.50 deg. F.
After 5 minutes...	59	16	54.00 ,,
After 10 minutes	59	15	54.00 ,,
After 15 minutes	56	19	55.00 ,,

OPERATION III.

	Pulse.	Resp.	Temperature of the water.
Before the process	72	16.5	50.00 deg. F.
After 5 minutes...	50	15	54.00 ,,
After 10 minutes	49	17	55.00 ,,
After 15 minutes	50	16	55.00 ,,

OPERATION IV.

	Pulse.	Resp.	Temperature of the water.
Before the process	60	16.5	52.00 deg. F.
After 5 minutes...	53	16.5	56.00 ,,
After 10 minutes	52	15.5	57.00 ,,
After 15 minutes	52	16	58.00 ,,

OPERATION V.

	Pulse.	Resp.	Temperature of the water.
Before the process	60	15.5	53.00 deg. F.
After 5 minutes...	52	15	57.50 ,,
After 10 minutes	52	15.5	58.50 ,,
After 15 minutes	51	16.5	59.00 ,,

Analysis of the Sitz Operations.

The first two series of experiments were performed upon a man of phlegmatic temperament, the third one upon the author, whose temperament is, if he himself can be said to be a judge, neither phlegmatic nor sanguine. It certainly, however, if it incline to either kind in particular, partakes more of the latter character than of the former. At all events, the two sets of operations should be considered first separately. Let us begin, then, with the first two series, and it will be found that these two series embrace a sequence of nine experiments.

By adding together the figures representing the state of the pulse before the commencement of the process in each of these experiments, and dividing the result by nine, it will be discovered that the average pulse previous to immersion in the bath was 75.88 beats per minute. By perform-

ing the same calculation with regard to the figures second in the column, the rapidity of the pulse, after five minutes' immersion, will be ascertained to be 60.11 beats per minute. In the same way, the pulse, after the expiration of ten minutes passed in the bath, will be found to present an average of 57.44, and after fifteen minutes 56.50. It will be observed, therefore, that the first five minutes' immersion caused a subsidence of the pulse of 15.77 beats, that of the second five minutes a further diminution of 2.67, and that of the third five minutes a still further diminution of $\frac{94}{100}$ of a beat. Hence, then, the sitz bath of a quarter of an hour's duration exercises a constantly depressing effect upon the pulse. That depression is the most marked within the first few minutes from the commencement of the bath, and becomes less and less so towards its conclusion. Now the first six of these nine experiments endured only a quarter of an hour, but the three last continued for thirty minutes. Let us see, therefore, what difference in the pulse the additional fifteen minutes effected. The average number of pulsations at the expiration of the half-hour, drawn from calculating the three baths of that duration, will be seen to be 46.66. This would seem to indicate a fall of nearly ten beats, for 56.50 was the last average calculated, namely, that one representing the state of the pulse after fifteen minutes' immersion. But this computation requires correction. To make it as far as possible exact, it is necessary to deduce an average for fifteen minutes from the same baths, and those only, whence has been deduced the average pulse for thirty minutes. And on making this correction, a considerable alteration will result. The average rapidity of the pulse, at the termination of fifteen minutes' immersion in the sitz-bath, derived from a calculation of the operations of the second series only, is 51.33. The fall, therefore, at the end of the half-hour, is not from 56.50, but from 51.33 to 46.66. So that there is a depression merely of 4.67, and not as according to the first computation, of nearly ten pulsations.

Let us now cast an eye upon the effect produced by the sitz-baths of these two series on the process of respiration.

By making precisely the same calculations, as were made in reference to the pulse, the average number of respirations will be discovered, as follows:—before the process, 19.39 per minute,—after five minutes' immersion, 19.77,—after ten minutes, 19.27,—after fifteen minutes, 19.27. It will be at once perceived that these different periods produce numerical alterations only in fractional quantities. Indeed it may be fairly said that hitherto the rapidity of respiration has been unaffected. But at the expiration of the half-hour the figures intimate an average of 18 respirations in the minute. If, however, we now inquire into what the medium speed of the breathing process was in the three operations of the second series, (namely, those only which were prolonged for thirty minutes), we shall perceive it to have been 18.66. Here then again appears a mere decimal alteration, the fall being sixty-six hundredths of a respiration in the minute. To repeat, then, we may fairly consider that while the pulse subsided from 75.88 to 46.66 (*a fall of nearly thirty beats!—of $\frac{2}{5}$ of its original number!*), the respiration was *unaffected.* No wonder the head is *not* congested by the sitz-bath! No wonder that, as will presently be explained, contrary to all preconceived opinions, it *relieves* headache, and sometimes cures it like a charm!

Hitherto we have considered the influence of the sitz-bath upon the respiration and circulation in the case of an individual of a phlegmatic temperament. Let us now turn to one of an intermediate constitutional disposition, neither very phlegmatic nor very sanguine, and see if the difference of temperament will cause the appearance of a difference in the results of the experiments. In the third series of operations the average rapidity of the pulse, ascertained in the usual manner, will disclose itself as follows:—before the commencement of the process, 64.60 beats in the minute.—(The observant reader will here think he has

caught the author tripping. He will remember to have seen an opinion of the latter, expressed in the beginning of the work, to the effect that one sign of a phlegmatic temperament was an habitually slow pulse. And yet here is a gentleman, who puts himself down as rather more inclining to the sanguine than to the phlegmatic disposition, but whose pulse, at the onset of the experiment, is absolutely considerably less frequent than that of him who underwent the two preceding series of operations, and who displayed the phlegmatic temperament in perfection. This apparently embarrassing contrariety, however, is to be explained away in the most simple manner in the world. *The author never took exercise before his baths; the other did invariably.*)—after the expiration of five minutes' immersion, 54.80,—after ten minutes, 53.60,—after fifteen minutes, 53.20. The first five minutes, therefore, caused a subsidence of ten beats within two-tenths; the second a further diminution of 1.2, and the third a still further reduction of .4. What a strong resemblance is here made manifest between the results of this series, and of the two last. It is true that in the latter the pulse had fallen more than fifteen beats in five minutes, but then the original pulse had been nearly 76, whereas in this series it is only 64. It could, so to speak, *afford* to fall more considerably. And accordingly it *did* fall 15.77 beats, while in the present series of operations it falls in the quarter of an hour just 11.40 pulsations.

Let us now examine the condition of the breathing apparatus in this set of experiments. It will be discovered that the average rapidity of the respiratory process for each operation, as deduced from the five of the series, is as follows :—before the process 16.70,—after five minutes 15.70, —after ten minutes 16.40,—after fifteen minutes 17.30. From these facts it will appear that, while the pulse was sinking ten beats, the respiratory process abated just one movement, and that, while the pulse continued to lose in

rapidity to the end of the process, the respiration began to *increase* in rapidity at the conclusion of the first five minutes and went on without interruption, increasing for the remainder of the fifteen minutes.

It will now be the correct moment to make inquiry into the effect upon the temperature of the water in the sitz-bath, produced by the immersion of the body. The average temperature of the bath, derived from a calculation upon the nine operations of the first and second series, is the following :—before the commencement of the process, 42.87° F.—after the lapse of five minutes 46.46° F.—after ten minutes 49.08° F.—after fifteen minutes 50.62° F.—and after thirty minutes 53.52° F. But if we calculate the average height of the thermometer at the end of fifteen minutes from the three last operations, (namely, those which endured for half an hour), we shall find it to be 50.33, instead of 50.62. And this must be done before it can be accurately laid down, as to how great an elevation of the thermometer took place between the expiration of fifteen and of thirty minutes. *Now* it can be stated safely that the temperature was elevated in five minutes from the period of immersion 3.59° F., in ten minutes was further elevated 2.62° F., in fifteen minutes still further 1.54° F., and in thirty minutes an additional 3.19° F., that is about one degree for every five minutes, but beyond a question considerably more for the first five minutes than for the last of the fifteen. In the operations performed upon the author the thermometric results were these :—average temperature of the water before the immersion of the body 50.80° F, after five minutes 55.00° F., after ten minutes 55.70° F., after fifteen minutes 56.20° F. It will be as well now to arrange a statistical table, embracing the average condition of pulse, respiration, and temperature of the water computed from a combination of these two analyses, in other words, from a combination of all three series of operations.

Statistics of the Sitz-Bath.

	Average Pulse.		Average Respiration.		Average Temperature of the water.
Before the process.	70.24	......	18.04	......	46.83 deg. F.
After 5 minutes ...	57.45	......	17.73	......	50.73 ,,
After 10 minutes ..	55.52	......	17.83	......	52.39 ,,
After 15 minutes ..	54.85	......	18.28	......	53.41 ,,
After 30 minutes ..	50.18	......	17.44	......	56.60 ,,

This table will represent as accurately as possible the general effect of a sitz-bath of five, ten, fifteen, or thirty minutes' duration. The reader may perhaps wonder how the last figures, namely those indicating the different averages at the expiration of thirty minutes, were obtained. If he will turn back to the description of the various movements of the pulse in the second series of operations, he will there find a calculation shewing that in the last half of a bath of thirty minutes' duration the pulsation of the heart subsided 4.67 beats. Now, if 4.67 be subtracted from 54.85, the average pulse given above as existing at the termination of fifteen minutes, the next number, 50.18, will be the result obtained. So with regard to the respiration and temperature. By referring to the analysis of the second series the reader may verify these statements, or rather figures, for himself.

It may be considered established therefore, that the sitz-bath greatly *depresses* the pulse, and leaves the respiration as nearly as may be *unaffected*, for, while the pulse falls more than 20 beats in the minute, the breathing drops only $\frac{6}{10}$ of a respiratory movement. Which diminution of the celerity of the pulse, and non-diminution of the respiratory process it is, that imparts to the sitz-bath its excellent property of dissipating headache, that is to say, headache commonly ascribed to determination of blood to the brain, or congestion of that organ. This affection is generally supposed to yield to the bath under discussion in consequence

of the latter's derivative operation. Its disappearance is ascribed to the determination of blood from the head to the parts immersed in water. And the argument adduced in support of this theory is the fact, that those parts are reddened by the process, indicating the presence of more blood circulating through the skin than previously. This is perfectly true, as far as it goes. But it is not enough. The author has known severe head-symptoms, as considerable torpor, muscæ volitantes, dimness of sight, &c., relieved by the sitz without altering the natural pallor of the skin in the slightest degree. He has also known a head-ache vanish almost in the act of sitting down in the water, and therefore before it was possible the integument could derive into its own capillaries the blood previously congesting the vessels of the brain. He mentioned before that a patient of his laboring under extensive disease of the lungs, (the result of an asthma of forty years' standing,) with considerable head complication never had his respiration more free, nor his brain more unclouded than in the sitz-bath. And yet this gentleman's skin was not at all reddened by the water, although the latter was of the natural temperature. The mode in which the author believes, (and surely his belief is grounded on substantial data, the most substantial of all, *actual experiments*,) the mode in which the sitz bath exercises what is called its beneficial derivative effect, is not really so much by *derivation* of blood, as by *purification* of that fluid. One word in explanation will not be thrown away. A person is afflicted with headache arising from congestion of the brain. At least he is told that this is the origin of his malady. He is assured that the brain is congested, that is, that the venous capillaries of that organ are distended, and contain more blood than they would in their normal condition, and that this superabundance of blood by the pressure upon contiguous parts gives rise to the symptoms, that have declared themselves. These symptoms, from the etymological

signification of the word, should be the external manifestations of some definite internal disease. But they are not. They merely shew that there is something wrong with the brain. What that something is, they do not demonstrate. Now let us inquire into the nature of those symptoms of congestion of the brain. And we shall find them to be something like the following:—impaired memory; confusion of ideas; incapability of sustaining the attention; deterioration of some one or more of the organs of special sensation, especially of sight or hearing; *increased* nervous sensibility, both general and local, the first displayed in what is called "nervousness," the second in neuralgic pains, or spasmodic affections; *deficient* nervous sensibility, evidenced by dullness of intellect, and muscular weakness, or paralysis; *perverted* nervous sensibility, made manifest by the production of unnatural sensations, as of water trickling down the spine, or ants creeping over the skin, or by erroneous impressions made upon the nerves of special sense, as in the seeing of silvery stars, black specks, clouds, and floating insects invisible to other eyes, or in recognising sounds unheard by other ears, or in the perception of odors, which other noses cannot appreciate; lastly pains in the head of various kinds and intensity, from a heavy dull weight to the feeling of a knife passing through the brain, or of a nail being driven into the skull. When these symptoms are more or less aggregated together, and their origin can be traced to too intense application to business, or to too close study; and when there is no reason to apprehend the presence of any more serious disease, as *inflammatory* congestion of the brain, or actual inflammation of that organ, or the growth of a tumor; and especially when they are associated with marked disturbance of the digestive viscera, they are at once said to indicate the existence of chronic or venous congestion of the head. But it has been said that they really indicate merely *some* disordered condition of the brain. That disordered condi-

tion, from the absence of actual inflammation, tumor, and so forth, is *presumed* to be congestion. But precisely the same symptoms are generated by too little blood, or by a vitiated state of that fluid. The former we see verified every day in those pale-faced, chlorotic girls, that we encounter at every turn in the street, and whose waxy complexions betray at once their complaint, and their bloodlessness as its cause. The latter is observed with equal clearness in different kinds of poisoning. What then is the direct evidence of the presence of congestion, that is, of capillaries distended with superabundant blood in cases characterized by the foregoing symptoms? There is absolutely none; no flushing of the face; no preternatural heat of the head; it may be according to the patient's perverted sensations abnormally hot, but not thermometrically, not appreciably to the hand of another individual; should the patient die, there are no *post mortem* appearances to warrant this supposition; at the inspection no distended capillaries, no superfluous quantity of blood are revealed to vision; but the substance of the brain is observed to be preternaturally dark, and this depends upon the fact of the blood contained therein being too dark, in other words too venous. Of such cases therefore as these, where the patient is said to labour under congestion of the brain, and dyspepsia, the author has conceived an opinion, differing from the received theory, but which is at once simple, definite, and most easily explained. The more he reflects upon it, and the more he sees of the disease under discussion, and the more he observes the effects of hydropathy, and particularly of the sitz bath upon that disease, the more does he become convinced of its truthful foundation. He has already shewn what a powerful and deleterious effect close confinement and sedentary habits exert upon the process of respiration. He has shown how this all-important, and most vital of all vital functions is thereby impeded in its duty,—how this impediment is inevitably

followed by the insufficient aëration of the blood in the pulmonary tissue,—how in consequence of this the expulsion through the air cells of the lungs of its carbonacious particles is imperfectly effected, and that thereby it retains certain noxious qualities characteristic of its previously venous, or impure condition,—how in this impure, *unarterialized* state it flows through the lungs into the arteries, and is by them distributed to every part of the body,—and how, by thus flowing into the various tissues, it is capable of generating, and does generate disease in those tissues. And this is precisely the author's view of the so-called "congestion of the brain" and "dyspepsia." He believes that they are neither of them local affections,—that neither the head, the stomach, nor the liver is more at fault than any other part of the frame,—that in such cases the whole system from the crown of the head to the sole of the foot is poisoned by the circulation of impure, undecarbonized blood. It is impure blood circulating through the brain, that gives rise to the brain symptoms. It is impure blood traversing the stomach, bowels, and liver, that gives rise to the stomach, bowel, and liver symptoms. It is impure blood supplying the substance of the muscles, that gives rise to the muscular debility. In short impure blood travels to every tissue, and every tissue suffers in consequence. Does not the invalid labouring under this malady, complicated in its catalogue of symptoms, yet simple in its origin, invariably tell you that he has not a healthy organ in his body, and that there is no part of his frame, wherein he does not sometimes suffer? Adopting then this simple view of the disease in question, how easy is it to understand the beneficial influence it derives from the use of the sitz-bath! Let a person be supposed to endure that series of symytoms which are attributed to congestion of the brain, but which the author has endeavoured to prove would more correctly be ascribed to the circulation in the brain of impure blood, blood imperfectly

decarbonized. Let him be placed in a sitz-bath. His pulse immediately commences diminishing in frequency, as may be seen by consulting the foregoing experiments. His respiratory function remains unaffected. A *less* quantity of blood therefore than usual meets the *usual* quantity of air, which consequently performs its purifying duties in a more efficient manner. For example, one respiration being generally achieved in the same time as 3.76 pulsations of the heart, (see experiments on this subject detailed in the chapter on the shallow-bath,) and one pint of air being inhaled at each respiration, it follows, if the pulse beat less frequently than in accordance with this proportion, and the rapidity of the respiration remain unaltered, there will not be sufficient blood pumped by the heart into the lungs to employ all the air inhaled. But if the blood circulating in the system be impure from imperfect decarbonization, this superabundance of air in the lungs is the very thing to cure it. And, by creating this superabundance of air in the lungs, the sitz-bath *does* cure it. It cures this general circulation and distribution of impure, undecarbonized blood. And as this impurity of the circulating fluid tells more powerfully upon the delicate tissue of the brain than upon any other organ, thereby developing cerebral symptoms more prominently than any other, in the same ratio is the beneficial influence of the sitz-bath, and indeed other hydropathic appliances, in the reduction of these symptoms, more particularly striking. Now let not the author be misunderstood. He does not for a moment deny the derivative action of the sitz-bath. But he does maintain that this derivative action is far from being its principal physiological effect. And to support this opinion he believes he has now brought forward sufficient evidence.

By reference to the statistical table of the sitz-bath the reader will observe the very definite ratio in which heat is transferred from the body to the water. Now it will be

immediately admitted, that the most tonic agent known is the application of cold, that is, the withdrawal of heat, just as the latter imponderable is the universal relaxing agent. The sitz-bath therefore agrees with most other hydropathic appliances, in being an excellent tonic.

The author begs here to draw the reader's attention to the fact, that great results and important inferences may follow apparently aimless experiments. As he has before mentioned, he instituted most of his experiments without any notion as to whither they would lead, and without the slightest intention of arriving at any particular result. He merely emptied his well to see if *any* truth, no matter of what kind, lay there concealed. He aimed at *any* information, that he might happen to find in his search. And seeing in the thermometer a likely path to pick up a little knowledge, or a few facts, he at once struck into it. Nor has his search in this direction, with reference to the sitz-bath, been without success. He has proved beyond a doubt, many useful things. For example he has shewn (see statistics of sitz-bath) that in a bath of fifteen minutes' duration more animal heat is abstracted during the first third than during the last two thirds of the operation, and therefore that *two sitz-baths of five minutes' continuance possess more tonic power than one bath of fifteen minutes' duration.* The thinking reader will be able to deduce many such important inferences through the whole of the work, which the author has not space to do for him. The book is already prolonged beyond his original design.

There is one class of affections, where the sitz-bath, administered in a peculiar way, has been found by the author to be of essential service. And this class is so common, so lamentably common, and so steadily increasing, that even a page or two devoted to its consideration will not be thrown away. The disorders alluded to are those connected with functional derangement of the womb, indicated by some disturbance of the menstrual secretion.

This disturbance may be exhibited in very many shapes. There may be *retention* of the *menses*, that is, the discharge may never have appeared, the proper age for its appearance having elapsed. Or there may be *suppression* of the *menses*, that is, the function, having been correctly discharged on previous occasions, shall have ceased to be so discharged. The secretion, regular in its periodic arrival, may be too scanty in quantity, or too abundant, constituting *deficient*, or *profuse menstruation*. Lastly, the menstrual product, normal in its period of advent, and accurate in its quantity, may be elaborated from the womb with great difficulty and suffering. But under whatever phase, or external manifestations this functional disarrangement of the uterine system may shew itself, it is nearly always accompanied by a *leucorrhœal* discharge, commonly known by the appellation of "*the whites*." And on the other hand the author will venture to assert with confidence from his own experience alone (although that of all the profession is in accordance, he believes, with his), that a leucorrhœal discharge, although more or less present in almost every woman who has been unwell for some time, is *never* unattended by strongly marked symptoms of uterine disturbance. (When he was a student at Guy's Hospital he was what is called "dresser," or "clinical clerk" to a ward appropriated to diseases of the womb alone. He had, therefore, peculiar opportunities of entering into the details of this class of cases, and investigating them thoroughly.) Indeed, in certain old-standing complaints of this nature there appears, as it seems to him, to be a kind of supplementary action between the leucorrhœal, or white, and the menstrual, or red, discharge. On these occasions the amount of the one secretion appears to bear an inverse ratio to that of the other. As the menstrual discharge increases in quantity, the leucorrhœal one diminishes, and as the former is diminished, the latter is augmented. Now, if some menstrual fluid be submitted to a chemical

and microscopical analysis, it will be found to contain all the ingredients of blood, with the exception of the self-coagulating substance, fibrine. It will be seen to be composed of *red* globules, albumen or white of egg, certain mineral salts, and water. If then, some leucorrhœal matter be investigated in a similar manner, it will reveal certain *white* globules, albumen, salts, and water. Here then it will be discovered, that these two apparently dissimilar fluids resemble each other in every particular, but in the nature of the globules contained. In the one case they are the red globules of the blood, in the other the white globules of mucus, or pus, accordingly as the leuchorrhœal discharge may display a mucous or purulent character. It will be easily perceived, therefore, how readily, cœteris paribus, the two secretions may be substituted for each other.

Now let us summon to our aid a supposititious case. A young lady goes to a ball. Before she goes, she is perfectly well, that is to say, as well as most young ladies are in the present state of society. Namely, her appetite is pretty good—fluctuating of course; she only has a head-ache now and then, and a pain in the back occasionally; pain in the left side we say nothing about, because all young ladies are subject to that; palpitation of the heart she is free from, *except* upon a little exertion; the bowels are somewhat constipated, but she *appears* to suffer no inconvenience from it, so what does that signify? She menstruates every month regularly as clock-work to a day, *but*—suffers considerable pain on each occasion, &c. Such a young lady, in such health, goes to a ball, concert, or some other fashionable, and therefore crowded, place of amusement, we will say, during her monthly period. Of course she remains till a late hour. She then, when her skin is at the hottest, and her excitement at the highest, steps out from an atmosphere of 80° F. into the cold, night air of 30° F., each, of course, more or less. Her body is shielded by the most flimsy attire, and

probably with no additional covering whatever, or merely a gauzy shawl thrown across her naked shoulders. She shivers as she springs into her carriage, and remains chilly till she reaches home. The next morning she is astonished to find she has taken cold. But there can be no doubt about the fact, for menstruation has ceased. But what is the immediate cause of this arrest of function? Let us sift it thoroughly; it will repay us with interest for the trouble. When the young lady was in the heated atmosphere of the assembly-room, there was a genial glow over the whole surface of the body, and the skin was perspiring freely. No sooner does she encounter the chilly air of night, than this copious discharge is checked. And the tide of blood, that was flowing into the skin to maintain this secretion, is bent from its course, and has to direct its current elsewhere. The organ, that in the case before us invites its approach, is the womb. But this organ is already congested in the natural fulfilment of its function of menstruation. When therefore it receives into its tissue an additional quantity of blood, it becomes more than congested. It inflames! Its lining membrane becomes dry, hot, painful, and tumid. The menstrual secretion, that was till then in action, is interrupted, and speedily stopped entirely. Now the arrest of any healthy function is *disease*. And the poor girl is now at all events, if she were not before, actually, unmistakeably diseased. And lucky is she if the distemper stop here. But frequently, alas! how frequently does it happen, that this is but the starting point of a course of miseries, that shall endure, till kind death removes her from their grasp. The engorgement of the womb is often followed by the appearance of a papular eruption, especially about the neck of the organ. And these pimples after a certain period ulcerate, producing open superficial sores. Now arise painful symptoms no longer of a temporary kind. Mucous, purulent, or bloody discharge flows from the ulcer. Neuralgic pain in

the back, abdomen, hips, and thighs harasses the patient. To this is added a sense of fulness, and bearing-down weight in the region of the uterus. Sympathetic feverishness deprives her of appetite, gives her occasional headache, heats and dries her skin, renders her nights wearisome and restless, and vitiates and 'obstructs all her secretions. After this she is probably confined to the recumbent position, and is in effect debarred half the pleasures of existence. In this miserable state the hapless lady may continue for many years. The complaint does not kill her. It were better perhaps if it did, for the blessings of life are sapped.

These latter remarks apply to the time before hydropathy was introduced, for the author *believes*, that the condition described above is totally incurable by medicinal means, and he *knows* it is very frequently curable by hydropathic. He has at this moment a lady in his house, who has suffered for six or seven years precisely in this manner—who has endured the most prolonged, and agonizing pains—who has undergone all sorts of medicinal treatment, with results generally detrimental, sometimes indifferent, never successful—who has been at other hydropathic establishments, always with some, however little benefit—and who is now, after having been a confirmed invalid for so many years, so remarkably improved, that there is no reason to doubt but that she will be perfectly restored. *Perfectly restored!* And that too after all the joys of existence had been turned into sorrows, and life had become an unwelcome partner.

But let us suppose that the affection under discussion has not arrived at this extreme point. The womb is engorged with blood, but there is no ulceration. Still there has probably been produced so much derangement of the uterus, as to unfit it for the discharge of its function of menstruation for the following one or more periods. And as the system would suffer, unless there were some supplementary action

instituted, nature calls upon another texture to undertake the office, which the uterus is no longer capable of performing. And in this way is established a *leucorrhœa.* But the part, whence this discharge issues, is not able to eliminate a *red* secretion, like the true menstrual fluid, but it can produce a *white* one, possessing very analagous qualities. This therefore is achieved, and now, instead of the normal periodic *red* menstruation, there is substituted an abnormal, persistent, but irregular, *white* menstruation. And when this state of things has once existed, all the medical faculty know how difficult it is to be *radically* cured. For, although after a certain time the uterus may recover itself, and become once more fit to accomplish its natural office, yet the parts upon which has devolved in the interim the uterine duty, manifested by the leucorrhœa, have become so accustomed to their unnatural state, that there is extreme difficulty in correcting it, and restoring to the uterus its legitimate secretion. Now it is here, in cases like these, where the judicious employment of the sitz-bath is invaluable. If the patient take a cold one of short duration, the water causes to contract all the blood-vessels that come within its influence. By this contraction are their contents in a certain measure squeezed from their interior. In other words the blood is driven from the parts immersed. And by a permanently astringing or tonic effect, exerted by the water upon the contracted coats of the vessels, it is also maintained at a distance. But the leucorrhœal discharge is formed both *from* and *of* the blood. Wherefore the greater the expulsion of blood from the parts, the more is the white secretion checked; which is the object desired. It follows from these premises, that the cold sitz should be employed only during the intervals between the periodic attempts at regular menstruation. Such periods are generally marked by some such symptoms, as pain in the back, or hips, or abdomen, bearing-down pains, headache, &c. During the prevalence of

these symptoms the cold sitz must give place to the hot one. In which case instead of an expulsion of blood from the parts immersed the contrary effect will be produced, namely, a *derivative one;* that is, the blood is drawn from all quarters towards the parts immersed. This therefore, aided by the natural efforts of the womb itself, is the very thing calculated to restore to that organ its proper function. Hence it appears, that a judicious interchange of the cold and hot sitz-bath in this kind of disturbance of the uterine system, is likely to be followed by the most beneficial results, suppressing the leucorrhœal discharge, or *white* and *spurious menstruation,* as it may be called, and reinstating the *red, natural,* and *real one.* Let the reader carefully bear in mind however the different circumstances to which particular attention must be paid. Firstly, the cold bath must be of short duration, and frequently repeated. Secondly, it must be discontinued, and the hot one substituted, as soon as the proper menstrual period is at hand, to be again repeated after that period has passed away. Thirdly, the hot bath must be *hot,* not tepid, and it should remain hot all the time the patient is immersed therein. Without strict attention to these points a failure will be the inevitable result.

In vicarious menstruation, that is, where in the place of the normal uterine discharge there is substituted a periodic escape of blood from some other part, as the nose, stomach, lungs, rectum, &c., this alternation of the hot and cold sitz is equally useful. In these cases the cold bath acts as a *tonic* to the uterus, imparting to that organ such strength as shall enable it to perform its functions when the proper period *shall* arrive, while the hot one is a *derivative,* drawing blood towards it, out of which it may elaborate the menstrual secretion, when the correct period *has* arrived.

It will perhaps not be an unapt method of concluding this treatise by drawing up a brief general

SUMMARY.

The wet-sheet lowers the pulse, diminishes the heat of surface, and relieves pain. It is therefore in medical language *an antiphlogistic or febrifuge, and an anodyne.* It corresponds to the *lancet or leech, antimony, calomel, and opium, and other febrifuge and anodyne mixtures.* It differs from the four first-named in not being followed by general debility, cachexia, &c.

The douche sometimes *elevates the pulse,* but always *accelerates the function of respiration,* thereby imparting an enlivening influence to all the vital phenomena. It is therefore *a diffusible stimulant.* Its physiological effects may be compared to those of *ammonia,* or those produced by the exhibition of *small,* that is, *stimulating doses of opium.* Of course its beneficial action is much more permanent than that of either medicine, and it is not liable to be followed by the deleterious consequences that the latter, even in the minutest quantity, does sometimes engender.

The blanket-packing quickens the pulse and produces perspiration. It is therefore *a stimulant and sudorific.* But both in its mode of stimulation, and in its sudorific properties it is peculiar, and stands alone. There is nothing in the pharmacopæia, to which it can be compared. The profession would do well to adopt this process into their therapeutic catalogue. In certain chronic diseases of the chylopoietic viscera, more especially of the liver, when it is not contra-indicated by any active irritation, they would find it a valuable addition to their remedial agents.

The shallow-bath generally *quickens both circulation and respiration,* always the latter. Like the douche therefore, it is a *diffusible stimulant,* but of less power.

The sitz-bath lowers the pulse, but leaves the *respiration unimpeded.* Moreover, with some exceptions it *reddens the skin* of the parts immersed, of course provided the process endure long enough. It is therefore a *sedative,* a

purifier of the blood, and a *derivative or counter-irritant.* In the first of these properties it perhaps more nearly resembles *foxglove* than any other drug. In its *third* effect, that of counter-irritation, it may be compared with *blisters* of different kinds and *liniments.* But with regard to its power of purifying the blood, of course no medicine can compete with it.

All the purely hydropathic appliances agree in one important peculiarity. The wet-sheet, the douche, the sitz, the shallow-bath, the other simple baths, as the can-douche and dripping sheet, nay, even the blanket-packing, all disturb the previous balance or equilibrium of the heart and lungs *in favour of the latter.* That is to say, the respiration is augmented beyond the proportional speed of the pulse. If the pulse be diminished in rapidity, the respiratory process remains unaffected. If the pulse be stationary, the respiratory movements are increased. If the pulse be accelerated, the respiration is still more accelerated. In the same ratio that this function is expedited, are the aëration and purification of the blood more complete; and, as this fluid of fluids becomes chastened in quality, so do all the complex processes of the economy become more perfect in their action; and as these functions recover their normal activity, old-standing and deep-rooted disease melts away, and long-absent health regains her ascendancy.

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